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# Life*

H. J. Muller

*Department of Zoology, Indiana University, Bloomington*

TO many an unsophisticated human being, the universe of stars seems only a fancy backdrop, provided for embellishing his own and his fellow-creatures' performances. On the other hand, from the converse position, that of the universe of stars, not only all human beings but the totality of life is merely a fancy kind of rust, afflicting the surfaces of certain lukewarm minor planets. However, even when we admit our own littleness and the egotistical complexion of our interest in this rust, we remain confronted with the question: What is it that causes the rust to be so very fancy?

In the childhood of our species, the answer to this question seemed obvious: Life is a spirit. This spirit, inhabiting the matter we call *living*, works its will upon it, enduing it with wondrous forms and with purposeful activities. Sometimes the idea of spirit was clothed in more pretentious terms, such as perfecting principle, entelechy, vital force, or mneme, yet all these still implied some sort of conscious or semiconscious entity, striving to dominate matter. The verbal subtlety of the terms veiled a naive animism.

## Life as Result of the Mode of Organization of Matter

The animistic view has been increasingly called into question. For instance, with the invention of machinery it was found that entirely lifeless matter can be fashioned into complex forms, capable of engaging in remarkable activities, some of them reminiscent of those of living things. Further, it was found that even in a state of nature some lifeless matter attains considerable complexity, and that in some cases it can give extraordinary reactions, which, although based on the regular principles of operation of lifeless material, simulate one or another supposedly "vital" phenomenon.

These doubts concerning the animistic interpretation were strengthened by the studies on living matter itself. All of its activities were found to conform strictly to the law of conservation of energy. That is, no energy was involved in any of its operations except what had been supplied to it from measurable physicochemical sources, nor was any of this energy done away with by it. Its atoms were found to be the same as atoms elsewhere. They were bound by the same rules into molecules. These molecules could in many cases be constructed artificially, and even the reactions that they underwent within living things could often be repeated in a test tube. Moreover, for some important operations, such as chromosome movements, for which physicochemical formulas were still lacking, regular rules of procedure were nevertheless discovered which elucidated age-old mysteries in terms of orderly material processes.

At the same time, however, such studies have revealed in living things greater and greater complications, which in this respect remove them ever further both from natural nonliving things and from artificial devices. For, as we examine the interior of a living thing and then magnify it more and more, we find at each successive level of magnification a new and different set of complications: first, on naked-eye inspection, that of organs then that of tissues, then of cells, then of cell parts and of parts within these, until immense molecules are reached, some containing hundreds of thousands of atoms, precisely and intricately arranged into groupings composed of subgroupings of several grades. Such molecules are present in even the simplest microbes known.

Yet this prodigious complication, even in its many still unexplained features, encourages not vitalism but the common-sense interpretation that it is this organization itself on which life's remarkable properties depend. If, on the contrary, an imponderable spirit were the source of life's capabilities, these complications would be superfluous. Daily this inference becomes reenforced as more and more of the operations of living things are traced to the orderly workings of given parts of the complex. Moveover, each living thing as a whol is ever more clearly seen to be one great integrated system, the operations of which are all coordinated in such a way that, collectively, they tend to result in one ultimate outcome: the maximal extension of the given type.

## Genesis of the Organization

Granting all this, the question is thereby rendered especially acute: How did these marvelous organizations, constituted in such a way as to achieve so peculiar an effect, come into being? The process of their origination, surely, appears at first thought to require some sort of conscious designing. To begin with, it was believed that all species had been designed and created separately in their present forms; but in the 19th century the evidence for their gradual interconnected development out of one or a few primitive forms that were the common ancestors of all became convincing. It was then speculated by certain schools that the ancestral organisms had been endowed with built-in, long-range designs that forced them to evolve as they did. Another view, which has been revived by the so-called "Michurinists" of Iron Curtain countries, where it has (until recently at any rate) been obligatory, postulated a generalized adaptive ability in liv-

ing things. By its means they altered themselves in advantageous ways when they were subjected to changed conditions and, along with this, they somehow implanted into their reproductive cells specifications for these same alterations. Such an ability to select and to install just the kind of alteration that is going to work out advantageously, *before it has been tried out,* clearly implies some sort of foresight, despite the disclaiming of this implication by some of the advocates of this view. In this case, then, the designing is merely done in bits, instead of in the grand manner.

Darwin's and Wallace's greatest contribution was to show that, even without planning, complex adaptations necessarily evolve. Since members of any population show manifold variations which their offspring tend to inherit, some of these variations—those that happen to be conducive to survival and multiplication—will find themselves more abundantly represented in the next generation. Thus the population will gradually accumulate more characteristics of an "adaptive" kind, that is, of a kind advantageous for the species' preservation and increase, even though there has been no tendency for helpful rather than harmful variations to arise in the first place.

In confirmation of this principle, modern studies in genetics, the science of heredity and variation, have shown that the great majority of newly arisen variations of an inheritable sort are indeed detrimental, as must be true of unplanned alterations that occur in a complex organization of any kind. Moreover, when outer conditions are changed, the few variations that happen to be useful in coping with these outer changes are found not to arise in greater relative abundance than they did before. Yet of course they do succeed better: that is, they are *naturally selected* afterward, in the actual tests of living.

## From Gene to Protoplasm

The major actor in this great drama of evolution by natural selection has proved to be the *gene,* a particle too tiny to be seen under the microscope but immense by inorganic standards. There are thousands of different genes in a cell of a plant or animal, each gene with its distinctive pattern and, in consequence, its special type of chemical influence. For the most part, at any rate, the genes are strung together to make up the threadlike bodies called *chromosomes,* which are visible under the microscope in the inner compartment or nucleus of the cell. Although the genes form only a small part of the cell's bulk, they control through their diverse products, primary, secondary, and more remote, the composition and the arrangement of most or all of the other materials in the cell and, therefore, in the entire body. Their control is a conditional one, however, since the nature of the setting in which the genes' products find themselves has much to do with which of their potentialities are allowed to come to fruition.

Recent evidence indicates that the gene consists of the substance known as *nucleic acid,* in the form of a much coiled chain, or double chain, composed of a great number (thousands) of links. The links, called *nucleotides,* are of only four kinds. Yet there are so many links in each chain that, through their different arrangements in line, they would make possible a practically unlimited number of kinds of genes. How such differing arrangements would result in the very different functional effects that different genes are known to exert is a question now being widely asked, but the attack on it is only beginning.

The most remarkable thing about the gene is that each huge chain-molecule has the faculty of capturing, by some specialized sort of affinity peculiar to its links, chemical groups in its vicinity which in some way correspond to these links. The captured groups thereby become matched up alongside the gene's links in an arrangement similar to that in the gene itself, and they are enabled to become bound together, just as the gene's own links are. As a result, they finally constitute another gene essentially like the original one. Thus the gene reproduces itself.

The details of gene reproduction have long eluded investigation. The most direct interpretation was to suppose that each subunit of the gene tended to attract and fasten next to itself a free subunit of the same type that happened to come into its neighborhood (*1*). Although the seeming attraction between like groups of genes (chromosomes) has lent support to this view (*2*), it has met with difficulties on physical grounds. Recently, however, my suggestion that the attraction may derive from electric oscillations has been developed by Jehle (*3*). Calculations of his group along these lines are now giving promising results (*4*).

On the other hand, a number of investigators have proposed that gene reproduction, instead of involving the direct capturing or molding of like by like subunits, is a two-step process in which each subunit of the gene captures or molds one of an opposite or "complementary" kind, and that when the complementary structure in turn captures or molds its own complement a formation like the original one becomes reconstructed. An analogy would be the use of a positive print to make a negative one, from which in turn another positive is derived (*5*). On the most recent and best supported variant of this idea, Watson and Crick, in a series of brilliant papers (*6*), have proposed that each nucleotide has as its complement a nucleotide of a given one of the three other types. By capturing their complements from materials in the medium about the gene, the chained nucleotides in a gene are thought to construct alongside themselves a complementary chain of nucleotides. This at its own next act of reproduction, by constructing a chain complementary to itself, gives rise to a formation identical in type with the original gene. Moreover, since on the view of these investigators the original chain is really a double one, with one member of the doublet the complement of the other to begin with, the construction by each of these two parallel chains of another chain complementary to itself would even at the first step result in a new pair of chains which, con-

sidered as a whole, would be identical with the original pair. Further complications have been proposed, involving interchanges of subunits between the original chains and those in process of formation (*7*), but as yet these serve to point up difficulties of the hypothesis rather than to answer them.

With the present activity in this field, it may well be that a relatively few years will suffice to establish definitely the solution of the problem of gene reproduction and, thus, to elucidate the most essential phenomenon in the operation of living matter. At this point, however, the important thing to note is the fact that, whatever the means by which it does so, each gene succeeds in constructing a physicochemical duplicate of itself. Later, when the cell containing the genes divides to form two daughter cells, the two identical genes that are present as a result of the duplication of every gene originally existing in the cell become drawn apart into different daughter cells. The fact that the genes are strung together in line to form the chromosomes provides a means for the orderly carrying out of this separation. Thereby the descendant cells come to contain identical genes.

Despite this identity of gene content, however, the groups of cells in different parts of a many-celled body are differentiated from one another. This is because the structure of the cells in each group results from a limited set of reactions, representing only a part of the numerous potentialities of the contained constellation of genes. These limits have been fixed by the special conditions prevailing within the given groups of cells. On the other hand, in a reproductive cell the same outfit of genes is sufficient, when multiplied, to organize the development of the entire body. In this way the genes serve as the basis of heredity.

On rare occasions a gene meets with an ultramicroscopic collision or other accident, which jolts its parts (or those of the duplicate that it has under construction) into a new arrangement, having a different chemical influence from before. We call this event a *mutation*. The mutant gene, in reproducing itself thereafter, tends to copy its new pattern as faithfully as the original gene had copied its old pattern. Thus, if the mutation has occurred in a reproductive cell, it may become evident as a variation inherited by a line of descendants. In this way, the mutations of the genes provide the inherited variations on which the process of evolution by natural selection is based. The reason why this role is reserved for the genes alone is that only they have the strange property of making copies of themselves in just such a way as to incorporate within the daughter particles even those features that have been newly introduced into their own structure. In other words, their most important peculiarity is their ability to reproduce, not merely themselves as they originally were, but also their variations (*2*).

The material that forms the bulk of most cells, although often designated by the single word *protoplasm*, is really a most elaborate composite of numerous constituents. The production of many of these constituents, including fundamentally important ones, has been shown to depend upon groups of special genes. Remove one of these genes and a given protoplasmic substance disappears or is replaced by something different; restore the gene and that protoplasmic substance reappears. In contrast to this, the production of any distinctive type of gene is not ordinarily a process initiated by the presence of certain distinctive protoplasmic substances. For, when a new type of gene arises by the mutation of some preexisting gene, this mutant gene proceeds to reproduce itself, along with the growth and division of the cell, even though the protoplasmic substances present were, to start with, no different from those in other cells not containing the given mutant gene. On the basis of this, as well as other considerations (including that of economy of assumptions), it is reasonable to infer that in the origination of life the gene arose first, and that protoplasm came into existence later, very gradually, in the form of a series of products of the chemical action of aggregates of genes that had mutated in such ways as to be able to give rise to these products. Protoplasm would thus consist of substances accessory to and produced by the genes. Its existence would be due to the fact that those mutant genes had been naturally selected whose products happened to afford chemical tools, such as enzymes, that are useful for the survival and multiplication of these genes themselves.

It may be concluded that the essence of life is not protoplasm or its operations, collectively termed *metabolism*, as has often been asserted, but that these are themselves results of biological evolution. Life's essence lies in the capability of undergoing such evolution, and this capability is inherent in the gene, by virtue of its property of duplicating its variations. At the present time, protoplasm is so highly evolved and complex, even in the most primitive cells known, that we should probably be justified in estimating the amount of advance in complexity between the stage of the simplest gene and that of a single cell, such as a bacterium, to be at least as great as that from the bacterium to the highest many-celled organism.

It is not surprising that, in the remote past, the gene itself should have come into existence. For conditions were such, in the envelopes of the primitive earth, that the accidental encounters of substances, together with the absorption of energetic radiation, continued during many millions of years, must have provided a tremendous accumulation of ever more complicated organic compounds, including many of those occurring today within cells (*8*). And if, among the myriad types of molecules thereby produced, genes were included (only one successful gene being required!), then the component parts also would already have been formed, out of which these genes could manufacture duplicates of themselves. Moreover, there would also be numerous other ready-made constituents present, which were capable of being utilized as accessory substances after mutations implementing such utilization had occurred in the descendant genes.

## Advances in Protoplasmic Organization

The chemical nature of the pathways whereby the genes control the composition and workings of the protoplasm have not yet been made clear. In any case, these pathways today involve so many steps and are so intricately branched and conjoined that much of the control is very indirect. With regard to the primary step in gene functioning, the long-neglected view is now gaining ground that this consists in the construction by the genes in the chromosomes of modified likenesses of themselves which enter the general protoplasm and there act as the genes' working delegates. Now that there is reason to regard the genes as being composed of nucleic acid, it is natural to suppose that the modified kind of nucleic acid, ribonucleic acid, found in high concentration in special protoplasmic granules, represents these gene delegates. Rich and Watson (*9*), who advocate this view, pres[illegible] evidence that this kind of nucleic acid, like that of the genes themselves, consists of coiled chains, possibly double, of nucleotides—in this case, however, of the four corresponding "ribonucleotide" types. Since the synthesis of protein and possibly of other substances occurs in association with these granules, it seems likely that it is the ribonucleotide chains in them that conduct this synthesis. Perhaps they also, to a limited extent, carry out some duplication of their own substance. The proteins and other materials, in their turn, engage in the multitudinous other reactions that occur in the cell.

In addition to those ribonucleotide links that are united in long chains, to form the ribonucleic acids, there are more or less separated units of them, and these have been found to be indispensable in many protoplasmic reactions. In these reactions they act as conveyors of large amounts of energy (carried on detachable phosphate groups) from one type of molecule to another, under the guidance of proteins and other companion substances. It may be that this special ability to transfer energy is also possessed by chained nucleotides and comes into play when they carry out their synthetic activities, both in gene duplication and in the building of other materials.

Aside from the nucleic acids themselves, the proteins are the most highly organized and diversified of the protoplasmic substances. In connection with most of the chemical steps taken by organic materials in protoplasm, there is some distinctive protein that acts as an enzyme for just that reaction—that is, a substance that induces the given change in other molecules without itself being used up. One or a few molecules of enzyme, because they can continue to do the same job repeatedly, are able to change a relatively large amount of other material. In consequence, an outfit of numerous different enzymes, sufficient for a multitude of different operations, can be contained within a minute bulk of protoplasm.

The molecules of proteins, like those of nucleic acids, are made up of chains, often coiled, composed of a great number of links. Important in determining the physical and chemical potentialities of any given protein molecule is (for one thing) the exact arrangement in line of its diverse types of links, called *amino-acid groups*. Nucleic-acid molecules, both those of the genes and those elsewhere (ribonucleic acids), commonly exist in close association with protein molecules. These and other considerations have lent plausibility to the idea that the building of protein molecules involves an activity of the nucleic acids of the genes somewhat resembling that by which they duplicate themselves. Even more likely is the possibility that the ribonucleic acids work in this way.

If, however, the construction of a protein molecule is pictured as a capturing, by the links of a nucleotide chain-molecule, of amino acids corresponding to these nucleotides, with the resultant formation of a parallel amino-acid chain-molecule, the difficulty arises that, whereas there are only four types of nucleotides, there are some two dozen types of amino acids. How then can a given nucleotide specify which amino acid is to be selected at a given point? Gamow (*10*) has suggested what appears to be a likely solution: namely, it takes a group of four neighboring nucleotides to capture one amino acid, and the type of amino acid selected depends upon how these four nucleotides (of their four possible types) are arranged with respect to one another, somewhat as the arrangement of letters determines the meaning of a word. He points out that, at any point in a coiled double chain of nucleotides, the number of effectively different arrangements of four neighboring nucleotides would just about correspond with the number of different types of amino acids in proteins. Whether or not the details of his hypothesis are correct, it would seem that some such relationship must exist if, as seems likely, the nucleic acids synthesize the proteins directly.

Even if the protein molecules are produced in this way in the first place, however, they would still be subject to considerable and diverse alterations afterward, since proteins are among the most modifiable substances known. It would therefore be unwarranted to suppose that any given enzyme or other protein of functional importance is the product of some one special gene alone and that other genes have played no part in the determination of its nature. In fact, there is, in particular cases, direct genetic evidence against this oversimplified view.

Whatever the means by which proteins and other organic substances were synthesized, there must, soon after the earliest stages of their association with genes, have been great advantage in the ability to utilize, as raw materials for them, other materials than those constituent groups out of which they were immediately put together in the process of capture and arrangement by nucleotide chains. These hitherto alien materials would become available for use if they could be subjected to reactions that converted them into such constituents, and these reactions could be brought about by appropriate enzymes and other accessory substances, resulting from given mutations of genes. Moreover, in the construction of some substances methods of their manufacture would be worked out which did not require any direct reshaping of their

constituents by the nucleotides themselves. In consequence, as the operations of gene aggregates, gradually aided by more numerous accessory substances, became more complicated through the natural selection of advantageous mutations in the genes, means must have been evolved for transforming into the materials of living things substances that required an ever more extended series of steps for the conversion process. At the same time, increasingly elaborate and effective methods were also developed for obtaining energy, storing it, and transferring it. Thus ultimately some organisms, the typical plants, became able to live entirely on certain inorganic substances and to derive their energy directly from the prime source, sunlight.

Other organisms meanwhile evolved mechanisms for utilizing other substances, some inorganic, some organic, for material, or for energy, or for both, until at last there was one vast interconnected system of living things on earth, diversely specialized chemically. This system kept in circulation the materials for life and also, until it had become dissipated, the captured energy, instead of letting them accumulate in the form of unusable wastes, as many of them must have done before. Life was thereby able to attain far greater abundance, faster turnover, increased diversity, and speedier, richer evolution.

Another circumstance that accelerated evolution, probably even at a prebacterial stage, was the establishment of sexual reproduction, in its more general sense of the coming together of two sets of genes from different sources. Before this process could be biologically effective, the series of maneuvers known as *meiosis* had to be developed. In meiosis some of the genes of each of the two sets that meet become recombined so as to form a single complete set. By the repetition of this process in successive generations, an entire population comes to constitute one great pool of genes, out of the innumerable shifting combinations of which the choicest (from the standpoint of self-perpetuation) tend to prevail. The accumulation of advantageous mutant genes is thereby caused to take place much more rapidly than in organisms that reproduce only asexually, which have their genes confined within mutually isolated lines of descent. Undoubtedly sexual reproduction owes its survival to the other advantages that, secondarily, accrued in its possessors by virtue of their faster evolution. Its function, therefore, is to make more effective the gene's ability to evolve.

Still another innovation the main significance of which lies in its hastening of evolution, or, to be more accurate, in its hindering of the retardation of evolution, is the natural death of the body. Of course this phenomenon arises, in its more typical manifestations, only in the later stages of evolution, in which organisms have become many-celled and have had their reproductive cells differentiated from the cells of their body proper. Natural death is not the expression of an inherent principle of protoplasm, but in each species natural selection has tended to develop a length of life that is optimal, in relation to the other characteristics of that species and to its conditions of living. In other words, death is an advantage to life. Its advantage lies chiefly in its giving ampler opportunities for the genes of the newer generation to have their merits tested out. That is, by clearing the way for fresh starts, it prevents the clogging of genetic progress by the older individuals. Secondarily, in higher organisms which as a result of the existence of natural death have allowed defects to develop during senescence, death has become doubly advantageous, in that it now serves also to sweep away these defects for which it is indirectly responsible.

Even before the attainment of the many-celled stage, with its complicated embryonic development, passing into adulthood, senescence, and death, many organisms had evolved regular sequences of transformations, constituting developmental cycles. They had also evolved numerous regulatory mechanisms that adapted them to environmental changes of those types that had been repeatedly encountered. Some of these mechanisms stabilized the organism internally, in reaction to outside disturbances; others set on foot operations that counteracted harmful circumstances or that took advantage of potentially helpful circumstances. Among the mechanisms were those that endowed the organism with the properties known loosely as *irritability, conductivity,* and *contractility,* all of which were so interadjusted as to result in adaptive (that is, advantageous) movements.

These diverse adaptive reactions all have their bases in specific structures, caused by genes, accidentally arisen by mutation, which had won out in the struggle for survival when the given conditions were met with many times in the past. They are not, however, expressions of any generalized adaptive ability, and they do not control the course of variation in the genes themselves. Thus the pre-Darwinian evolutionists and their Michurinist descendants have put the cart before the horse in assuming that living matter, by virtue of its inherent nature, makes an effort to adapt itself directly to new circumstances, and that evolution has consisted in the accumulation, by inheritance, of the adaptations thereby evoked.

### Plant and Animal Ways

In some lines of one-celled organisms, which had probably been typical plants, adjustments of the structures subserving movement enabled the organism to add to its income by capturing and assimilating bits of already formed organic material and finally even other organisms. It then proved profitable for them to concentrate entirely on the predatory mode of life, with resultant loss of most synthetic abilities and ever-increasing development of the motor ones. Thus animals arose.

Although animals and plants thereafter diverged, there were some parallelisms in their evolution. In both groups increased size proved advantageous for some ways of living and was accomplished by the integration of many cells into a larger organism. This in turn allowed the development of far greater spe-

cialization of parts. However, in plants the fact that the supplies needed could usually be had best by simply "staying put" and reaching steadily out for them caused this specialization to take the form of relatively motionless branched structures, with (for land plants) roots in the ground for securing minerals and water, leaves above for sunlight and carbon dioxide, and a strong conducting structure between. Movements were still necessary to bring the male reproductive cells to the eggs and to disseminate the products of fertilization, but these were in the main accomplished passively, by mechanisms that utilized motions of water, air, or animals.

On the animal side, the nature of the food put a premium on the development of means of capturing it and of avoiding being captured. It is true that many small bits of food which floated or swam through water could be caught even by sedentary animals, provided that these sifted the food out from the water that was swept by them or sucked into them. Hence such animals are often plantlike in appearance. But more of a challenge was presented by food that was large, well protected, difficult of access, elusive, or possessed of counteractivity. The more the food used had such characteristics, the more advantageous was it for the animal to develop adroitness and strength of movement, including locomotion. The same capabilities also became valuable in protecting it against predators equipped with them. In varied lines of animals, therefore, natural selection favored the accumulation of those mutations that resulted in more effective sensory, coordinating, motor, and supporting systems. At the same time, since the exercise of strength requires a comparatively massive body, in the interior of which materials are not introduced or removed at a fast enough rate by diffusion alone to service a high level of activity, it became important to elaborate systems for ingesting and processing food materials and oxygen, for supplying them effectively to the cells, and for extracting and eliminating the wastes.

The strikingly divergent forms taken by many of these advances in different groups were, of course, evolved in adaptation to their great differences in circumstances and ways of living. Often these differences were in considerable measure dependent upon one or a few major peculiarities of their construction, such as a gliding membrane or tube-feet, which furnished a key to the mode of construction of many other parts. It is evident that some of the features, including even some of those in the key positions, were originally adopted, at least in the particular form taken by them, as a result of some unusual combination of minor, temporary circumstances, which would be unlikely to recur. Having once arisen, however, they proved their usefulness, which sometimes extended to some very different function, and they thereby became a solid, important part of the pattern of the organism. In this position, they might help to determine the natural selection of a long series of further steps, proceeding in a given direction. Because the method of evolution was thus opportunistic instead of farsighted, it is found that organisms, despite the marvelous interworking of their parts, conceal many imperfections and indirections of structure and functioning. In fact, evolution presents such a curious combination of arbitrariness and consequentialness as to lead us to infer that on another world physically like ours only remotely analogous forms of life would have evolved.

### Learning and Consciousness

Among the more regularly occurring of the higher developments in active animals is the elaboration of the coordinating system and the inclusion within it of mechanisms for modifying its operations in adjustment with the individual's experiences. The basic feature in this process, which from the objective standpoint is called *conditioning* and from the subjective standpoint *learning* or *association*, is the formation of connections among different groups of neuronic (nerve cell) reactions that have been aroused at or nearly at the same time, so that subsequently the arousal of either tends to invoke the other as well. These connections form an ever more intricate web, since if reaction-group $A$ becomes connected with $B$ at one time and $B$ becomes connected with $C$ at another time, it follows that $A$ thereby becomes connected with $C$, in the arrangement $ABC$.

Also essential in learning is the procedure called *analysis*, whereby particular components or relationships existing within a neuronic reaction-complex become dissected out, as it were, so that when they occur in different settings they can serve to cross-connect these other features with one another, somewhat as $B$ connected $A$ and $C$ in the foregoing illustration. Doubtless there are as yet unguessed but far-reaching inherited neural mechanisms that effect the isolation of certain characteristic relationships, such as (on a sensory-motor level) possession of the same color or motion of a given kind across the field of view. However, much of the analysis at deeper levels depends also upon associational procedures in which the neuronic reaction-complex is subjected to various learned operations. These, in modifying it, bring out features implicit in it which it shares with some other complex.

All these processes become useful to the organism only by virtue of their modification of its behavior. This modification is made possible by the fact that the neuronic activities for movements become strengthened or inhibited according to whether these movements have been followed by experiences (neuronic reactions and reaction-complexes) of the types subjectively designated as desirable or undesirable. Which experiences are originally felt to be desirable or undesirable, and which emotional and behavioral ("instinctive") responses are concomitantly aroused by them, are matters determined by inherited neuronic structures. These have been shaped by evolution in such wise that the creature, in working for its own goals, unwittingly furthers the multiplication of its kind. However, through association it learns to achieve its primary desires by more effective means, better

adjusted to the circumstances surrounding it, and learns to coordinate and subordinate its different desires to one another so as to attain greater total gratification.

Despite our present ignorance of the nature of the physicochemical bases of all these phenomena, their physicochemical *existence* is attested by numerous facts of observation and experiment.

As, through association and analysis, an increasingly coherent and serviceable formulation or representation of the world outside becomes built up out of the neuronic reaction-complexes, we become justified in speaking of intelligence. Only here, at last, does foresight make its debut in the operations of living things. Moreover, within this same neuronic reaction-system, a representation of the individual himself, including his own associations, gradually takes its place. A speaking individual, in referring to this phenomenon, then uses the expression *consciousness* or some equivalent.

Although this term denotes what may be called the inner or subjective view of oneself, it is only by a confusion of ideas that it is thought of as implying the existence of two "parallel sides," conscious and material, to neuronic or other processes: that is, two systems of phenomena that coexist and completely correspond but do not interact. If this view were correct the existence of consciousness, being only "parallel," could in no way affect our behavior. Hence we could not speak of it. Nor could we, for that matter, even think of it (for the conscious could no more than parallel the material side, and the latter could not be affected by the former). It follows that the conscious phenomena *are* the physicochemical phenomena or, at least, are some integrated portion of them. In other words, matter and mind present no real antithesis. Moreover, in the case of mind, as in the case of life, its difference from matter and energy in their more ordinary forms lies in the peculiarities of its mode of organization and resultant operation.

## Pooling of Learning

Turning to a consideration of the native intelligence of our own species, we find that it is not so very much greater than that of some other existing animals. However, this relatively moderate difference, taken in conjunction with man's social disposition and with his queer proclivities for vocalizing and symbolizing, enables him far more effectively than other animals to communicate with others of his kind. This has resulted in his social evolution, by the accumulation of tradition, a process wherein each individual becomes provided with the distilled experience of a vast, ever-increasing body of his ancestors and associates. Through this knowledge and the cooperative activities and resultant material equipment based upon it, man has become incomparably more potent than any other form of life on earth, even without any perceptible improvement having taken place in his genes since before civilization began.

It is true that ancient tradition is often faulty and tends to overelaborate itself by an inner inertia in arbitrary and injurious ways. Moreover, the strange human propensity for symbolization, although invaluable not only for communication but for thought itself, has often led men astray, running away with them, causing them to misinterpret and glorify their own symbols, and to confuse them with the things denoted. But with the increase of useful knowledge men have come to realize that tradition, even when ancient, is manmade, and that only the systematic testing, unhampered criticism, and rational judgment denoted as *science* can give them a more correct understanding of things. By the conscious, organized use of this method life today, in the form of man, is ever more rapidly reaching out to new spheres and to new modes of existence. At the same time, transcending its role of animal, it is making its position firmer by learning to promote, and in part even to supersede, the synthetic functions of the plant kingdom.

It must be recognized that at this point man's social development has lagged far behind his "material" development, and that the resultant insufficiency of cooperation among his own members may bring about the annihilation of his hard-won achievements, if not of man himself. Alternatively, he may begin to advance to hitherto unimagined outer and inner conquests. Such advance, however, will require a wisdom that can be gained only by genuinely free inquiry, based solidly upon our advancing knowledge of the nature of things and backed by the broadest, most unbiased good will.

If our dangerous drifting from one short-range goal to another is to be replaced by really long-range foresight, we shall have to overhaul courageously all our ancient standards of value, for value judgments, far from being immune to scientific investigation as is sometimes asserted, should be a main object of such study. In accordance with the conclusions thereby reached, we shall then have the task of modifying our systems of inner motivation and the relationships of individual with individual and group with group. Recognizing that our conscious objectives, which we subsume under the expression *the pursuit of happiness,* are the complex and modifiable resultants of more primitive urges chosen by natural selection in compliance with the pressure of the gene to preserve itself and to extend its domain, we must seek more *functional* ways of pursuing happiness. These should more successfully harmonize the gene's trend to increase and evolve with the deepest fulfillment of our conscious natures, so that the serving of either of these ends will by that very act promote the other. In fact, any other policy is ultimately self-defeating, in this world of interpenetrating competition and cooperation.

## Crisis in Gene Increase

It is, however, a mistake to assume that the gene's tendency to increase gives biological victory to the or-

ganisms with the highest gross fertility. In general, the "higher" the organism, the greater the security of individual life that it achieves and the lower its production of offspring. Natural selection has decreased the fertility because, with too high a pressure toward population increase, the well-being and efficiency of the organisms are so reduced as actually to lower the potential of the species to undergo biological expansion. In fact, civilized man, through his advanced techniques, has attained such security of life (except for war!) that an even lower fertility now becomes appropriate for him, both biologically and for his individual happiness, than that which was established for him by natural selection in adjustment to primitive conditions.

Civilized man is now going part of the way toward meeting this requirement artificially, by means of birth control, but it will be necessary for him to make much more widespread and adequate use of such technique, in order that he may attain and maintain a world-wide optimum per-capita supply of energy and of food and other materials. Otherwise he would be forced back into a misery and disorganization that would not only rob him of most of the benefits of his previous progress but would find him deprived, perhaps permanently, of the resources needed to raise himself again and at last to expand into new and more commodious realms of living. Thus it is preeminently true of civilized man that his success in pursuing happiness is a necessary basis for the success of his genes in their job of multiplication. Conversely, however, the pursuit of happiness must also be so directed as ultimately to lead to biological expansion, if man is to utilize his opportunities for bringing "the greatest good to the greatest number," and if he is to minimize the risks of disaster and of being left behind in the universal struggle for existence.

But even if we grant that man will achieve adequate control over his numbers and will advance to untold reaches in his social evolution, all this progress must still rest on a crumbling biological basis, unless not merely the quantity but also the quality of that basis is vigilantly taken care of. For the artificial saving of lives under modern civilization will allow the increasing accumulation of detrimental mutant genes, unless this accumulation is deliberately compensated by an enlightened control over the types of genes to be reproduced. This course of action, to be both sound in its direction and effective in its execution, must be entered upon not under complusion but in the spirit of freely given cooperation, founded not upon illusions but upon the idealism that is natural to men who engage in a great mutual endeavor.

### Man a Transitional Phase

The spirit thus aroused would inevitably tend to proceed further, to the realization that the mere prevention of deterioration is an inadequate, uninspiring biological ideal and that instead, by extension and supplementation of the methods followed for maintaining our genetic foundation as it is, it can actually be raised to ever higher levels. Acceptance of this course will be facilitated by the rapid growth of human understanding and technical proficiency that we see under way about us now. This present progress is, as we have seen, not based on any changes in the hereditary endowment but only on the extreme responsiveness of the human organism, even with its present endowment, to educational and other environmental influences. But great as are the advances possible in this way, men cannot remain satisfied with them alone when they become aware of the vastly greater enhancement of life that could result from the combination of this kind of progress with that in their underlying genetic constitution. This would include the genetic remodeling of our primitive urges, the improvement of our intellectual ability, and even of our body construction.

There is no limit in sight to the possible extent of such advances, provided that we *will* them to take place. However, the possibility of their coming about automatically, by the type of unconscious natural selection that has operated in past ages, has been done away with, as is explained earlier, by the conditions resulting from social evolution. For these conditions rightly lead to the increasing protection, by society at large, of those who are weak and ailing by heredity, as well as of those handicapped by misfortunes caused by outer circumstances. Yet at the same time this very social evolution has provided and will provide increasingly effective knowledge and techniques for the voluntary, artificial guidance of biological evolution. These make available, in compensation for the deficiency of natural selection under civilization, novel means of directing many of the processes involved in reproduction and heredity.

Among the methods of this kind that are being, and will be further, developed are those for managing the generation and the storage of the reproductive cells, both within the body and outside of it, those for artificially controlling insemination and fertilization, for instigating parthenogenesis and twinning or polyembryony, and for instituting foster pregnancy. It should be possible eventually to find ways of influencing the behavior and distribution of the chromosomes themselves. Means of substituting, for the original nuclei of eggs, other cell nuclei, of chosen types, are even now being worked out, and such operations may in time be made fine enough to deal with individual chromosomes or their parts. Far more remote and unlikely than these possibilities, however, is that of regulating the direction taken by the mutations of genes.

However that may be, the rate at which biological progress could be made even by the means available today is already incomparably greater than that to which it was limited by the slow unconscious processes of nature. Only fear of the dead hand of ancient superstition today holds most men back from a recognition of these opportunities for greater life. But, with the progress of enlightenment, this fear must

wither away. Thus, man as we know him is to be regarded as only a transitional operative in the progression of life, but one that commands a critical turning of the road. For at this point the method of evolution may change from the unconscious to the conscious, from that of trial and error to that of long-range foresight.

Man in the shackles of authoritarianism is incapable of such advances. Should he attempt them, his efforts would be misdirected and corrupting. But, with the amplified opportunity to create that is his when he is free to see things as they are, he will find his greatest inspiration in the realization that he is by no means the final acme and end of existence, but that, through his own efforts, he may become the favored vehicle of life today. That is, he can be the means whereby life is conducted onward and outward, to forms in ever better harmony within themselves, with one another, and with outer nature, endowed with ever keener sentience, deeper wisdom, and further reaching powers.

Who can say how far this seed of self-awareness and self-transfiguration that is within us may in ages to come extend itself down the corridors of the cosmos, challenging in its progression those insensate forces and masses in relation to which it has seemed to be but a trivial infestation or rust? For the law of the gene is ever to increase and to evolve to such forms as will more effectively manipulate and control materials outside itself so as to safeguard and promote its own increase. And if the mindless gene has thereby generated mind and foresight and then advanced this product from the individual to the social mind, to what reaches may not we and our heirs, the incarnations of that social mind, be able, if we will, to carry consciously the conquests of life?

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# Herbert Osborn: Scientist, Teacher, Leader of Men

ONE of this country's greatest entomologists, Dr. Herbert Osborn, died 20 September 1954, in Columbus, Ohio, at the age of 98. His accomplishments as a scientist and teacher insure him a permanent place among America's men of science.

Today, the American people are among the healthiest and best fed of any on earth. This is due, in part, to the profound effect of research in the control of insect pests and to successful efforts on the part of our public to control its insect enemies.

Without the control of insect pests, our national annual agricultural production—crops and livestock—would be half or less than they are today. In addition, insect-borne diseases would cause thousands of deaths and hundreds of thousands of illnesses each year.

Economic and health benefits such as these stemmed from the pioneer efforts of far-seeing entomologists like Dr. Osborn. He, together with a tiny number of other dedicated persons, brought about the successes of economic entomology that are well known to everyone today.

Dr. Osborn was born in Wisconsin on 19 March 1856. Thus, his life span almost duplicated the first century of professional entomology—1854–1954. His first paying job concerned knocking Colorado potato beetles into a can for later destruction. By the time he was 15, he had lived through the greatest agricultural catastrophe this country has ever seen—the horrible grasshopper plagues of the 1870's. For three straight years grasshoppers destroyed almost all the agricultural production of the soils from Texas into Canada and from the Rocky Mountains into Illinois. In these boyhood days, he saw the Hessian fly destroy 50 to 90 percent of the wheat crops of early settlers almost every year. No one knew then how such pests could be controlled or how losses they caused could be prevented.

Young Osborn decided to take on that job. He dedicated himself not to the study of generalized entomology but to a search for ways to protect people and their crops, livestock, and possessions from insect depredation.

Osborn received his B.S. degree in 1879 and M.S. degree in 1880—both from Iowa State College. He taught at Iowa State College for the next 19 years.

He served Iowa as state entomologist and entomologist for the State Agricultural Experiment Station and, at the same time, was a special agent for the Bureau of Entomology, USDA.

During this period of research for the Federal Government, Dr. Osborn conducted the first comprehensive study of insects, ticks, and mites that affect and carry diseases to man and domestic animals. In a publication issued by the U.S. Department of Agriculture in 1896 following these studies, he described methods for the control of such pests. So far-reaching were these methods that many of them still were in general use in 1945. The appearance of hydrocarbon insecticides, such as DDT, in 1945 changed some of them, but basic control measures that he suggested remain almost the same now as when he first published them 58 years ago.

Osborn became head of the department of zoology and entomology at Ohio State University in 1898. He knew by that time that the dozen or so trained agricultural entomologists then in existence were incapable of doing all the work that needed to be done. He thereupon developed the idea of establishing a school for the sole purpose of training entomologists skilled in controlling insect pests and able to tell people how they could do the job themselves.

When he retired from active teaching in 1916, Osborn had seen a majority of this country's economic entomologists receive all or part of their technical education and training in his classes. E. O. Essig said, in his *A History of Entomology* (1931):

> He probably trained more entomologists in America than any other teacher. His students are now to be found in every State in this country and in most foreign countries. Many of them are in positions of great responsibility.

No less than 25 percent of the 4500 professional entomologists in the United States received all or part of their training in the department of zoology and entomology, Ohio State University, and many of them were in Dr. Osborn's classes.

Osborn received honorary degrees from Iowa State College in 1916, University of Pittsburgh in 1930, and Ohio State University in 1936. He was a member of numerous scientific organizations, both domestic and foreign and was president of five of them. He was a life member of several, including the California Academy of Sciences and Le Société Entomologique de France. He was editor of a number of scientific journals over the years.

Honors due a great scientist were given Osborn during his lifetime. Today we feel the force of the contribution that he made to our national economy through teaching. But this is only a beginning. We cannot even guess how much his services will mean to the future of the peoples of this earth.

DAVID G. HALL

*5814 North Ninth Road,*
*Arlington 5, Virginia*

# *News and Notes*

## Electrolytes in Biological Systems

The annual meeting of the Society of General Physiologists was held at the Marine Biological Laboratory, Woods Hole, Mass., 8–9 Sept., with 90 registrants. The first day was devoted to a symposium on *Electrolytes in Biological Systems,* dedicated to W. J. V. Osterhout and M. H. Jacobs, which is summarized here by its organizer, A. M. Shanes.

Dean B. Cowie and Richard B. Roberts described careful and extensive radioisotope studies with *E. coli, T. utilis* and *N. crassa,* which revealed a high rate of entry into or exit from the cellular water by ions, glucose-1-phosphate, fructose-1:6-phosphate, cystine, glutamate, methionine, and glutathione. Proteins, however, are excluded. Penetration also was demonstrated by the competitive displacement, by exogenous labeled or unlabeled amino acids, of amino acids produced by the bacteria from glucose precursor. The authors concluded that the protoplasm of these microorganisms is in direct contact with the environment, the cell membrane being unable to affect appreciably the movement of small molecules; how the cells retain their metabolic intermediates under these circumstances was discussed.

"Sodium and potassium regulation in *Ulva lactuca* and *Valonia macrophysa*" was described by George T. Scott and Hugh R. Hayward. The dependence of normal ion distributions on metabolic processes was demonstrated by the effects of metabolic inhibitors and by the ability of substrates and of photosynthetic processes to counteract these inhibitors. Of particular importance, in the light of the recent tendency to emphasize the sodium ion, was the clear demonstration that the kinetics of sodium and potassium movement can be quite different or completely independent.

In his paper, "Relationship of cell surface enzymes to ion transport in yeast," Aser Rothstein described the biochemical and ionic interactions that experiments in his laboratory indicate to be restricted to the surface of the yeast cells, and their implications for ion transfer.

"Electrolyte transport in mitochondria" was discussed by Gilbert Mudge. The metabolic activity of the mitochondria partially determines the concentration and rate of exchange of potassium but not of sodium. These isolated organelles were found to contain 3 times as much potassium as sodium. The experimental conditions, that is, the manner of preparation and the concentrations of various components in the medium, were shown to be extremely important for the nature of the results.

Daniel C. Tosteson, in reviewing literature on the erythrocyte, pointed out that available evidence indicates that potassium outflux and sodium influx are governed by electrochemical gradients, while the reverse fluxes involve chemical interactions with the surface of the cells. Red cells treated with n-butanol and those taken from the duck were found to be more suitable for an experimental analysis of these fluxes than normal human red cells. The significance of findings with these preparations was discussed.

In the "Factors governing ion transfer in 'resting' nerve," presented by Abraham M. Shanes, special emphasis was given to the link between metabolism and ionic fluxes. Changes in influx and outflux in the presence of inhibitors and substrates provide a means of distinguishing among at least four possible metabolism-dependent mechanisms, namely, intracellular ion binding, membrane selectivity, membrane potential production, or direct transport at the cell surface. It was pointed out that caution is necessary in applying hypothetical relationships, which purport to distinguish passive from active transfer, to actively metabolizing cells.

"Ion transport and ion exchange in frog skin" was summarized by Ernst G. Huf. Subjects discussed were fluid transport, movement of cations other than sodium, the structure of frog skin, experimental modification of the potassium content of the skin, and factors governing the active transport of sodium, particularly the part played by potassium.

Abstracts of the symposium papers and of the 18 short research papers given on the second day will appear in the *Journal of Cellular and Comparative Physiology*.

At the business meeting the elections of C. Stacy French as vice president and of Hans Gaffron and Leigh Chadwick as councilors were announced, and president-elect F. A. Brown, Jr., was reappointed to the editorial board of *Physiological Reviews*. John Buck continues as secretary-treasurer. The meeting closed with a notable social hour at the L. V. Heilbrunn estate.

JOHN BUCK

*National Institutes of Health, Bethesda, Maryland*

## Science News

In connection with the recent **suit for patent infringement** filed by Mary A. Marcus against Selman A. Waksman [Science **120**, 966 (10 Dec. 1954)], the trustees of the Rutgers Research and Endowment Foundation have issued a statement, which says:

> The trustees . . . will fight in court the . . . charges . . . because they are brought without the slightest legal, scientific or moral foundation. . . . The Marcus charge that Dr. Waksman appropriated any of her work is false. Messrs. Cooper, Byrne, Dunham, Keith & Dearborn, patent counsel for the Foundation, . . . have rendered their opinion . . . that streptomycin produced under the Foundation's patent does not infringe Miss Marcus' patent and that the streptomycin patent is valid. . . .
>
> The vaccine and extract covered by Miss Marcus' patent were claimed therein to be a remedy for one specific disease, psoriasis. . . . Her vaccine and extract are not, and never have been, employed as a recognized treatment for psoriasis or any other disease. . . .
>
> The integrity and validity of the Marcus claim are completely refuted by her long delay in asserting them. The tremendously important investigations of Dr. Waksman and his associates have been extensively reported over a period of fifteen years in the scientific literature and the public press. The streptomycin patent now under attack was issued September 21, 1948. . . .

Plans for wider use of **atomic power in the United Kingdom** received additional impetus with the recent opening by the Atomic Energy Authority of the Reactor School at Harwell. The school will offer a 3-mo, $700 course to students from private industry in the techniques of atomic power, with particular emphasis on the design and construction of power stations.

Opening the school, John Cockcroft, director of the Atomic Energy Research Establishment, foresaw a developmental period of 8 yr during which electricity will be generated by the first power stations (now under construction), improved stations will be erected, and full-scale breeder reactors will be built that will do work that now requires 20 million tons of coal. The reactor school represents U.K. industry's first opportunity to enter the field of atomic power; though operation of the power stations is to be in the hands of the state-owned British Electrical Authority, it is evident that nuclear power is no longer to be a Government monopoly.

An Indiana University research team, headed by Marvin Carmack, chemistry department, and W. R. Breneman, zoology department, will test *Lithospermum ruderale*, a plant used medicinally by Western American Indians that may be effective against some kinds of tumors. The Cancer Institute of the U.S. Public Health Service has awarded $26,000 for the study.

A dependable, inexpensive, easily portable apparatus for making **direct blood pressure readings** has been developed by the Laboratory of Technical Development of the National Heart Institute, Bethesda, Md. The device, when attached to a conventional electrocardiograph, produces accurate pressure recordings formerly available only by the use of costly and complex instruments.

Physicians find the customary inflated cuff method of taking an indirect blood pressure reading satisfactory for most diagnostic purposes. Occasionally, however, to obtain very precise measurements, it is necessary to read blood pressure directly within the blood vessel. The complicated apparatus heretofore required for doing this has usually been available only in special clinics or large hospitals. With the new develop-

ment, physicians now can utilize their own electrocardiographs to record pressures taken through a strain gage pressure pickup.

F. W. Noble, J. J. Callaway, and B. B. Boone, of the National Heart Institute, recently described the new instrument in the *Journal of Laboratory and Clinical Medicine*. They added a switch and capacitors to a commercially available strain gage type manometer so that information about direct blood pressure is translated into an electric form acceptable to the conventional electrocardiograph. A technical development linking and improving upon existing instrumentation, this new method has been demonstrated to be dependable and satisfactory in clinical trials. It is expected to provide savings in time and expense over present techniques and apparatus.

A group of Albany physicians headed by C. Stuart Welch, has reported **transplanting a liver** from one animal to another. The group has indicated that the experiment—performed on dogs—was the first successful transplanting of this type reported in medical history. The experiment, involving grafting the liver of one dog into the abdomen of another, succeeded several times. After the operations the livers functioned, in producing bile, for as long as 5 days. However, Welch commented that it was "highly improbable" that the experiments would lead within the foreseeable future to transplanting of human livers. Livers are one of the most difficult human organs to keep alive.

The regents of the University of California have paid in full the **claims of 5 former professors** involved in a loyalty oath controversy. The men resigned from Berkeley after the regents, at the direction of the California Supreme Court, had ordered them reinstated with 16 others dismissed in 1950. The 21 faculty members refused to sign a special loyalty declaration that was later declared unconstitutional. They sued the regents for their salaries or for severance pay.

According to Stanley A. Wiegel, attorney for the professors, no settlement offers have been made to the 16 who returned to the university. Included in the group of 5 was Gian Carlo Wick, now professor of physics at the Carnegie Institute of Technology.

On 13 Dec., Gibson E. Gorman, Superior Court judge in Chicago, ruled that a baby born of **artificial insemination** was illegitimate when the donor was a third party. In an unusual decision, the jurist also held that the wife who had insemination from a third party was guilty of adultery, irrespective of the husband's consent. But if the husband is the donor, artificial insemination does not violate public policy or morals and is not adultery.

The issue is one that has had few court tests and has resulted in conflicting opinions. The American Medical Association has said that it knows of only three previous court decisions, one by the New York State Supreme Court in 1947 holding that such a child was not illegitimate; the court ruled that the husband, while not contributing to conception, assumed the role of foster or adoptive father. A 1948 case in Great Britain held that insemination did not consummate a marriage. In a 1921 case in Canada, the courts intimated, but did not rule specifically, that insemination without consent of the husband was adultery.

R. G. Bunge, W. C. Keettel, and J. K. Sherman of the State University of Iowa have established a **frozen human semen bank**, probably the first of its kind. They let its existence be known in a recent report on the semen freezing and storing method published in the journal of the American Society for the Study of Sterility. Three normal babies have already been born, and a fourth is almost ready to be born, fathered by human semen frozen and stored in the bank.

Physiologists have long wondered why the **hearts of hibernating animals** do not stop when body temperatures drop to the hibernating point, sometimes only a few degrees above freezing. The hearts of ordinary animals stop long before reaching the temperature at which hibernators spend the winter. Peter R. Morrison and A. R. Dawe, respectively of the zoology and physiology departments at the University of Wisconsin, have found that the hearts of animals going into hibernation are hyperirritable, and the slightest stimulus will cause them to beat furiously at near-normal temperature. But this same hyperirritability will keep them beating slowly at extremely low temperature that would stop the heart of a nonhibernator.

Morrison collected northern hedgehogs, Arctic ground squirrels, and Franklin ground squirrels on a trip to Alaska that was part of an Air Force-sponsored research project to study problems of cold survival. The hyperirritability of the hearts of these three northern animals develops when the temperature of the animal's body is reduced to about 68°F. In deep hibernation the heart rate slows to as few as 2.2 beats/min, and it may show unusual patterns such as paired beats or beats in bursts. On the way out of hibernation the increase in heart rate precedes any rise in body temperature. If it could be learned what causes the hyperirritability of the hearts, the information might have practical application in human "deep-freeze" heart surgery.

A new instrument, a **penetrometer**, that provides a method for measuring the compactness of underwater sediments without disturbing them has been developed by scientists at the University of Rhode Island under contract with the Office of Naval Research and the Navy Hydrographic Office. The new instrument consists of a steel tube with a probe on the end that is driven through a hollow shaft into the bottom by a motor and a mechanism that measures and makes a permanent record of resistance at depths up to 200 ft. The working mechanism is mounted on a 5-ft frame resembling a bell buoy. It weighs 145 lb without the lead weights that hold it in position underwater. The

motor for driving the probe is equipped with a watertight cover that can be pressurized. In addition to probing the ocean bottom, the penetrometer may be used on land as a soil-mechanics instrument for highway planning.

The **giant American redwood** is being hybridized and transplanted by Russian foresters and botanists. In *Voks*, the bulletin of the U.S.S.R. Society for Cultural Relations with Foreign Countries, it is reported that "one can already see three-year-old sequoias around Moscow." Apparently the first redwoods were brought to Russia in the 1860's but in "tsarist Russia," the article states, they were grown exclusively to decorate parks on the southern coast of the Crimea and the Caucasus. Now, however, Soviet scientists have tried introducing the sequoia into the forests of the Crimea and other parts of the Soviet Union. "Using Michurin's [Michurin is considered the Burbank of Russia] methods, botanists have set themselves the task of moving sequoias farther north."

Excellent provision for the **housing of large animals** has been made at the National Institutes of Health, Bethesda, Md. The new quarters, providing outdoor exercise facilities, the opportunity for companionship, efficiency in cleaning and maintenance, and good ventilation, were designed under the supervision of W. T. S. Thorp, former chief of the section of comparative pathology and hematology and of the laboratory aids branch, and now assistant dean and director of the School of Veterinary Medicine at the University of Minnesota. The quarters are well worth a visit by persons planning new accommodations for experimental animals.

One of the richest **titanium deposits in the world**, consisting of mountains of high-grade rutile ore, is about to be tapped by the Republic Steel Corp. of Cleveland to give the United States a new supply of the strong, rustless, light metal for use in jet planes, rockets, air-borne equipment, armor, and eventually in all fields of industry. The new mine, discovered a little more than 1 yr ago, lies near Pluma Hidalgo, Oaxaca, Mex. Already more than 25 million tons of ore, expected to average at least 20 percent titanium dioxide (rutile) have been proved by digging into the mountainsides with exploratory tunnels or adits. In one place the rock runs 95 percent rutile.

One of the most interesting among the lesser-known activities of the South Pacific Comission is the work being done to **trace and preserve valuable manuscripts** on the islands. Usually these are grammars, dictionaries, vernacular textbooks and similar linguistic works; but many manuscript histories, studies of local peoples, collections of folklore, family records and the like are also known to exist. Members of the commission staff are assiduously tracking down manuscripts and typescripts of all kinds likely to be of value to scientists or historians. In each case the present owner, when found, is asked to loan it to the commission for photocopying and immediate return.

When the photocopies have been prepared, one is sent to the Library of Deposit nominated by the member government to whose territory the original manuscript relates. Additional copies of each manuscript are also made available at cost to any organization or individual desiring to purchase them on application to the Executive Officer for Social Development, Box 5254, GPO, Sydney, N.S.W., Australia. Notification of copying and deposit is made by numbered deposit notices published in the commission's *Quarterly Bulletin*. More than 35 manuscripts and typescripts have been copied up to the present.

Fred L. Soper, director of Pan American Sanitary Bureau, Regional Office of the World Health Organization, recently called a conference in Washington, D.C., on **yellow fever**. An outbreak of the disease in Trinidad focused attention on the potential hazard in the United States, whose southern half has extensive areas harboring the yellow fever mosquito *Aedes aegypti*. Attending the conference were officials of the U.S. Public Health Service, the Army and Navy, the Atomic Energy Commission, the State Department, the Rockefeller Foundation, the Gorgas Memorial Institute, and the Pan American Sanitary Bureau.

One yellow fever patient, or an apparently healthy person carrying the yellow fever virus, could start an epidemic if he or she reached one of our *Aedes*-harboring ports and was bitten by one of these mosquitoes which could then spread the disease. Yellow fever in Trinidad this past fall cost that small place $23 million because of quarantine and consequent loss of trade and tourists. *Aedes aegypti*, which can survive winter as far north as Norfolk, Va., could be eradicated from the United States at relatively small cost.

Theodor Svedberg, founder and head of the Gustav Werner Physics Institute, Uppsala, Sweden, who was Nobel prize winner in chemistry in 1926, has originated two **scientific textile designs**. Exploding atoms—in cyclamen, Chinese lacquer red, and orange on black squares—are printed on dove-grey coarse linens. Physicists can recognize Bohr's electronic curve, which surrounds the atomic nucleus, and also the spiral of an atomic explosion caused by cosmic radiation and caught on a photographic plate. After completing the atomic drapery, Svedberg turned his attention to genetics and devised "Chromosomes." The color scheme is black on dove-grey linen with white stripes.

A new 36-min movie, **"The Wisconsin cleft palate story,"** in sound and color, has been produced by the Wisconsin Bureau for Handicapped Children, Department of Public Instruction, in cooperation with the University of Wisconsin Medical School, Department of Speech, and University Hospitals. It shows the integration of services necessary in the rehabilitation of a cleft-palate child. The film can be rented from the Bureau of Visual Instruction, University of Wiscon-

sin, 1323 W. Johnson St., Madison, for a nominal fee. It is available for purchase through the Photographic Laboratory, University of Wisconsin Extension Division, 1204 W. Johnson St.

Discovery of a **new antibiotic, primycin,** has been announced by T. Valyi-Nagy, J. Uri, and I. Szilagyi of the University of Debrecen, Hungary, in the 11 Dec. issue of *Nature*. The material is made by microorganisms found in the larvae of the wax moth, *Galeria melonella*. Primycin seems to be active against viruses, as well as against such larger organisms as the staphylococci that cause boils. Although good results in treating superficial infections in man are reported, the new antibiotic may have limited usefulness, for trials on animals showed it to be toxic.

Reorganization of the U.S. Department of Agriculture's research in **forest insects and forest diseases in the Northeast** has been completed. Under the reorganization, R. C. Brown, entomologist, and J. R. Hansbrough, pathologist, are now members of the staff of the Northeastern Forest Experiment Station, with headquarters at Upper Darby, Pa. Brown is chief of the experiment station's new division of forest insect research; Hansbrough is chief of the new division of forest disease research. Both men were formerly stationed at New Haven, Conn.

Most of the technical personnel in forest insect and disease research are to remain in New Haven. Their combined offices there will be known as the Forest Insect and Disease Laboratory of the Northeastern Forest Experiment Station. Philip B. Dowden is administrative officer for the New Haven laboratory.

## Scientists in the News

**Harvey L. White,** professor of physiology and head of the department at the Washington University School of Medicine, St. Louis, will be the George Cyril Graves lecturer in physiology at the Indiana University School of Medicine, 10–19 Jan. His topic will be *Some Aspects of Renal Physiology*. The annual lectureship was established in 1948 in honor of Dr. Graves, who in 1940 bequeathed his entire estate to the physiology department.

The New York State Museum and Science Service has announced the formation of the New York State Geological Survey, which combines the offices of geology and paleontology into a single administrative and scientific unit under the leadership of **John G. Broughton,** the State geologist.

**Christopher C. Shaw,** captain, U.S. Navy, and senior medical officer at the Philadelphia Naval Shipyard, has been awarded the Sir Henry Wellcome medal and $500 prize money given annually for an essay judged to be "the most useful original investigation in the field of military medicine."

**Gordon N. Scott,** consulting engineer in Los Angeles, and **W. H. J. Vernon** of England have been selected to receive 1955 National Association of Corrosion Engineers awards. The awards will be made during the NACE 11th annual Conference and Exposition in Chicago, 7–11 March. Scott, who has been in corrosion work more than 20 yr, will receive the Frank Newman Speller award. He has written many papers on cathodic protection and coating of underground and underwater structures and was a contributor to the only proceedings published by NACE following its first meeting in 1944. Vernon will receive the Willis Rodney Whitney award. He has published many treatises on corrosion and its relationships to bacteria, inhibitors, coatings, economics, and so forth.

**J. F. Wallace,** formerly director of the Rodman Laboratories at Watertown Arsenal, Boston, has been appointed associate professor in the department of metallurgical engineering, Case Institute of Technology. At Rodman he supervised research and development work in the processing and fabrication of new metals and alloys for both industrial and military applications.

The William H. Walker award of the American Institute of Chemical Engineers has been given to **Edwin R. Gilliland,** professor of chemical engineering at Massachusetts Institute of Technology, in recognition of his publication record during the past few years and in particular for four papers contributed to *Chemical Engineering Progress*. Gilliland is an authority on separation processes and applied industrial chemistry.

At its annual meeting in Cleveland on 4 Nov., the American Documentation Institute presented a scroll of appreciation to **Atherton Seidell,** one of its founders. Seidell was one of the first to propose the extension of library services to scientists by microfilm. He worked to establish microfilm services in the Library of the U.S. Department of Agriculture, the Armed Forces Medical Library, the Pasteur Institute, the Faculty of Medicine of the University of Paris, and several other French centers.

Seidell's enthusiasm for microfilm grew from his need for copies of chemistry papers for research in connection with his work on solubilities, a book widely used by chemists. He has said that without microfilm copies of papers in libraries all over the world the book could not have been compiled. As a consequence, he was a pioneer in the establishment of free microfilm services in research libraries.

In order to inform the medical profession of new articles available on microfilm, he founded, in 1941, the *Current List of Medical Literature*, a publication that has become one of the world's great scientific indexes. Seidell is also noted for his efforts in promoting an inexpensive viewer for short strips of microfilm, and a microfilm projector well within the means of the independent researcher.

**Irwin H. Slater,** former assistant professor of pharmacology at the University of Rochester School of Medicine and Dentistry, has joined the research laboratories of Eli Lilly and Co., Indianapolis, where he is in charge of neuropharmacology in the pharmacological division.

**Besse B. Day,** formerly in charge of the statistical office of the U.S.N. Engineering Experiment Station, Annapolis, Md., has been transferred to the Bureau of Ships, Department of the Navy, Washington. The new position carries the responsibility for developing and coordinating a program of statistical techniques for all of the bureau's experimental work. **F. R. Del Priore** will head the statistical work at the Annapolis experiment station.

The American Institute of Chemists has awarded its annual achievement citation to **Eduard Farber,** chief chemist of the lumber and wood products laboratory of Timber Engineering Co., research affiliate of the National Lumber Manufacturers Association. Farber was cited for his achievements in wood chemistry and forest products utilization, and for his contributions to the history of chemistry.

**Alfred Blalock,** professor and director of the department of surgery, Johns Hopkins University, will deliver the Roswell Park lecture sponsored by the Buffalo Surgical Society on 10 Feb. 1955. Blalock will be awarded the society's gold medal, the eighth time the award has been made since its inception in honor of Dr. Park, professor of surgery at the University of Buffalo from 1883 through 1914.

**Louis A. Krumholz,** former staff member of the information and reports division of Oak Ridge National Laboratory, has taken charge of the Lerner Marine Laboratory on North Bimini Island, Bahamas, British West Indies. The laboratory was set up in 1947 to further the investigation of the fundamental aspects of marine biology, and is owned and operated by the American Museum of Natural History, New York.

**Frank Fremont-Smith,** medical director of Josiah Macy, Jr. Foundation, and president of the World Federation for Mental Health, has joined **John R. Rees,** director of the federation, on a tour of countries in the Middle and Far East. The two scientists will establish relationships and explore ways in which the organization may extend its mental health and human relations activities into those regions.

**T. A. Bancroft,** director of the Statistical Laboratory, Iowa State College, has been on a 3-mo assignment in the Near East and India at the request of the Food and Agriculture Organization of the United Nations. During the first 6 wk he visited experiment stations and ministries of agriculture in Egypt, Syria, Iran, and Iraq to collect information on the present use of experimental designs and survey techniques in research investigations. After that he lectured at the Experimental Designs Training Center, in New Delhi, which is sponsored by FAO.

Another professor in the Iowa Statistical Laboratory, **George W. Snedecor,** will also be on special assignment as a consultant in experimental statistics for the Institute of Statistics, Consolidated University of North Carolina, for 4 mo beginning in January. He will work primarily with the staff of the Woman's College in Greensboro and also with the staff of the Negro Agricultural and Technical College there.

Texas Medical Center, Houston, announces the following appointments:

**Arthur Kirschbaum,** formerly professor and head of the department of anatomy at the University of Illinois, has been named professor and chairman of the department of anatomy at Baylor University College of Medicine. At present he holds the same position at the University of Texas Dental Branch.

**Leon Dmochowski,** former experimental pathologist in cancer research at the School of Medicine, University of Leeds, England, and visiting professor of microbiology at Columbia University, will be professor of anatomy at Baylor and consultant in electron microscopy at Anderson Hospital.

**Henry Browning,** who has been assistant professor of anatomy at Yale University and associate professor of anatomy at both the University of Puerto Rico and Indiana University, will be associate professor of anatomy at both Baylor and the University of Texas Dental Branch.

**John Trentin,** formerly assistant professor of anatomy at Yale, was appointed July 1 as associate professor of anatomy at Baylor and at the dental branch.

The American Institute of Chemical Engineers announces the retirement of **Stephen L. Tyler,** secretary and executive secretary of the institute for 17 yr. At the time Tyler joined the institute in 1937 membership was 1486. It has now grown to 14,500. On 1 Jan. 1955 Tyler will become secretary of the committee on education of the Engineers' Council for Professional Development, a conference of engineering societies. **F. J. Van Antwerpen,** editor of the institute's periodical *Chemical Engineering Progress,* will succeed Tyler.

On 31 Dec. **George A. Baitsell,** a former editor of *Science,* retired as editor of the *American Scientist*; he will serve as science editor for the Yale University Press. The *American Scientist* editorial office will be at Princeton University, with **H. S. Taylor,** dean of the graduate school, as the new editor.

**R. Tucker Abbott** has been announced as the first incumbent of the Henry A. Pilsbry Chair of Malacology established by the Academy of Natural Sciences of Philadelphia in recognition of the work of **Henry A. Pilsbry,** a world authority on mollusks and curator of mollusks and other invertebrates for the academy,

now in his 92nd year. The endowment for the chair is being provided by Alfred J. Ostheimer, president of the Natural Science Foundation, and other friends of the academy. Abbott, a native of Watertown, Mass., has been associate curator of mollusks for the U.S. National Museum, Washington. He is the author of the recently published *American Seashells,* an identification guide to 1500 American marine mollusks [*Scientific Monthly* 79, 414 (Dec. 1954)].

**William F. Ashe,** newly appointed chairman of the department of preventive medicine at Ohio State University, has returned from India where he was a consultant in thermal environmental health attached to the FOA Technical Cooperation Mission in New Delhi. He will travel to India periodically to analyze data gathered and to help formulate recommendations to management, labor, and government concerning the solution of worker health and productivity problems resulting from the "heat loads" in India's industrial plants.

**Harry A. Winne,** electrical engineer and retired vice president of General Electric Co., will be presented the 1954 John Fritz medal during the winter general meeting of the American Institute of Electrical Engineers in February in New York. Winne will be honored "for service to his country in war and peace through his distinguished leadership in the electrical industry." He is the 51st winner of the medal.

## Necrology

**John A. Britton, Jr.,** petroleum engineer and retired director of the Enjay Company, Short Hills, N.J., 16 Dec.; **John A. Caputo,** 56, oral surgeon and former professor at the New York University College of Dentistry, New York, 17 Dec.; **George L. Carlisle,** 77, mining engineer, explorer, and conservationist, Norfolk, Conn., 22 Dec.; **Charles M. Child,** 85, professor emeritus of zoology of the University of Chicago, author, and investigator at the Marine Laboratories of Stanford University, Calif., 20 Dec.; **John A. Donnellon,** 41, associate professor of education at Maryland College, Scranton, Pa., 21 Dec.; **Ida T. Hill,** 79, archeologist and author, New York, 21 Dec.; **John Poindexter,** 37, plant morphologist and assistant professor of biology at Occidental College, Los Angeles, 11 Dec.; **Pierre Sergescu,** 60, mathematician, former director of the Polytechnical School of Bucharest, and permanent secretary of the International Union of Sciences, Paris, 22 Dec.; **Frances I. Seymour,** 54, gynecologist, author, editor, and director of the National Research Foundation for Fertility, New York, 17 Dec.; **Harry L. Shoemaker,** 62, civil engineer and retired executive of the Standard Oil Company, East Orange, N.J., 19 Dec.; **Russell W. Stovel,** 77, electrical engineer and authority on electric generating stations, Upper Montclair, N.J., 21 Dec.; **Elizabeth C. White,** 83, pomologist, Whitebog, N.J., 27 Nov.

## Meetings

The National Academy of Sciences–National Research Council was asked by officials of both industry and Government to establish within the Academy–Research Council framework a committee to concern itself with the common interests and relationships of industrial and governmental research, particularly in the area of applied research. Conferences between industrial and governmental research executives and directors recommended that a small committee be organized to explore the need for better acquaintance and understanding between Government and industry research leaders, and to consider methods for accomplishing this objective. As a result, the **Government-Industry Research Committee** has been organized, with the following membership: Edgar C. Bain, United States Steel Corp., chairman; Allen V. Astin, National Bureau of Standards; D. P. Barnard, Deputy Assistant Secretary of Defense, Research and Development; Ralph Bowin, Bell Telephone Laboratories, Inc.; Ralph Connor, Rohm and Haas Co.; Hugh L. Dryden, National Advisory Committee for Aeronautics; Paul D. Foote, Gulf Research and Development Co.; G. E. Hilbert, Agricultural Research Service, U.S. Department of Agriculture; Randolph Major, Merck and Co., Inc.; Roy C. Newton, Swift and Co.; Alan T. Waterman, National Science Foundation.

At its first meeting the committee concluded that effective mechanisms already exist in many fields for furthering mutually helpful relations between Government and industrial research. However, the committee agreed to hold itself available as necessary to assist in exchanging views and ideas designed to improve such relations where either Government or industry groups may feel this to be desirable. When its services are requested, the committee proposes to consider first the extent to which the need can be satisfied by existing mechanisms. If appropriate, the committee will then consider designation of an *ad hoc* group of individuals active in the particular field concerned to assist in bringing about improved understanding and closer relationships between Government and industry people in that field.

The **American Orthopsychiatric Association** will hold its 32nd annual meeting at the Hotel Sherman, Chicago, Ill., 28 Feb.–2 Mar. 1955. This is the first meeting of the association in Chicago since 1949. Approximately 100 scientific papers will be presented by psychiatrists, psychologists, social workers, educators, sociologists, and anthropologists. There will be all-day sections on childhood schizophrenia, child development, and psychotherapy with children. Visual material of specific use in mental health education will be presented for 2 days. Twelve workshops are planned, and numerous technical and commercial exhibits will be on display. Papers, symposiums, and round tables will discuss a wide range of orthopsychiatric interests including adolescence, juvenile delinquency, testing, use of the clinic team, research,

treatment of psychosomatic disturbances, mental health in the community, rehabilitation, desegration, and other related material.

The American Orthopsychiatric Association, founded in 1924, is an interdisciplinary association of psychiatrists, psychologists, social workers and members of allied fields, including education, anthropology and sociology. Its members come from all parts of the United States, Canada, and abroad. Inquiries should be directed to Dr. Marion F. Langer, American Orthopsychiatric Association, 1790 Broadway, New York 19.

The New Jersey Academy of Science will hold its **first annual meeting** in Chester on 29 Jan. The program will be largely organizational in character. Abstracts of papers to be presented must reach the secretary, C. J. Daley, Audiovisual Dept., Cranford High School, Cranford, N.J. *not later than 15 Jan.* All those planning to attend should notify the secretary *by 24 Jan.*

Supported by the largest group of sponsors since its founding in 1950, the fifth annual **Rochester conference on high energy nuclear physics** will be held at the University of Rochester 31 Jan.–2 Feb. under the chairmanship of Robert E. Marshak, who is also chairman of the University of Rochester physics department. The purpose of the conference is to bring together a representative group of leaders in experimental accelerator physics, cosmic radiation, and theoretical physics for a full and informal discussion of latest results and developments.

The sponsors of the conference this year include the International Union of Pure and Applied Science, the National Science Foundation, the U.S. Atomic Energy Commission, the U.S. Office of Naval Research, and a group of Rochester industries. Foreign representation is expected to be unusually large—approximately 30 scientists from at least 12 countries. Total registration is limited to 100 invited scientists. A complete record of the proceedings will be made available after the meetings. Subjects tentatively scheduled for discussion include nucleon scattering at high energies, including polarization effects; meson physics, including meson field theory; and elementary particles. The conference dates were chosen so that participants can include in their travel plans the meeting of the American Physical Society, 27–29 Jan., in New York.

## Society Elections

**Southern Society of Cancer Cytology:** pres., H. Hudnall Ware; pres.-elect and sec., J. Ernest Ayre; treas., J. K. Cline. The vice presidents are C. C. Erickson and L. I. Platt.

**Alabama Academy of Science:** pres., William T. Wilks, State Teachers College, Troy, Ala.; chairman local arrangements committee, Henry Wlaker, University of Alabama.

**American Society for Horticultural Science:** pres., E. S. Haber, Iowa State College; v. pres., M. B. Davis, Central Experimental Farm, Ottawa, Canada; sec.-treas., Freeman S. Howlett, Ohio Agricultural Experiment Station, Wooster; ed-bus. mgr. for the *Proceedings*, Henry Munger, Cornell University.

**American Institute of Chemical Engineers:** pres., Barnett F. Dodge, department of chemical engineering, Yale University; v. pres., Arthur K. Doolittle, Carbon and Carbide Chemicals Co., So. Charleston, W. Va.; treas., George Granger Brown, dean of engineering, University of Michigan; exec. sec., F. J. Van Antwerpen, editor of the A.I.Ch.E. journal, *Chemical Engineering Progress*.

**Association of American Medical Colleges:** pres., Vernon W. Lippard, Yale University School of Medicine; pres.-elect, Robert A. Moore, Schools of the Health Sciences, University of Pittsburgh.

**Institute of Radio Engineers:** pres., John D. Ryder, Michigan State College; v. pres., Franz Tank, Swiss Institute of Technology.

**Central Society for Clinical Research:** pres., Clayton G. Loosli, University of Chicago; v. pres., Randall Sprague, Mayo Clinic, Rochester, Minn.; sec.-treas., Robert H. Ebert, University of Chicago.

**Tennessee Academy of Science:** pres., Frederick T. Wolfe, Vanderbilt University, Nashville; v. pres., C. S. Chadwick, Geo. Peabody College for Teachers, Nashville; sec., Isabel H. Tipton, University of Tennessee, Knoxville; treas., James W. White, University of Tennessee, Knoxville.

## Education

**New York University** has released the following new faculty salary schedule: professors, $9000 to $16,000; associate professors, $6500 to $9500; assistant professors, $5000 to $7000; instructors, $3600 to $5000. Salaries of all faculty members now below the minimum will be increased at least to the minimum figure for next year. An increase in student tuition from $20 to $25 per point was also announced.

An **artificial kidney** that employs sausage casings to purify human blood is now ready for use at **Stanford School of Medicine** in San Francisco. The device, one of less than a dozen artificial kidneys in the nation, will be operated under the supervision of J. Max Rukes. The new machine will be available to physicians generally and will be used for urologic research.

The **University of Kansas City** is making use of R.C.A. "TV eye" **closed-circuit television** equipment as a classroom aid in teaching dental surgery. Through the use of the compact equipment, built around a

small TV camera weighing less than 5 lb, surgeons at the university's School of Dentistry are enabled to project close-up details of oral operations to more than 100 students seated in a lecture hall a floor away.

The installation was a gift to the School of Dentistry from the alumni association. It includes a telescopic lens fitted to the camera that allows it to "get inside" the patient's mouth and a two-way intercommunication system by which the surgeon can describe the operation as he performs it and hear and answer questions from the students.

The **Netherlands Universities Foundation for International Co-operation** announced that its annual summer session will be held 19 July–6 Aug. at the University of Groningen. The session is entitled "Trends in modern civilization," with the subclassification "Civilization and technics." Information and forms for registration may be secured from Mrs. A. F. P. Volten, Secretary, Summer Session NUFFIC, 27 Molenstraat, The Hague, Netherlands.

**New York University** recently dedicated its new **Institute of Mathematical Sciences** for advanced research and instruction. Niels Bohr, Nobel prize winner and Danish physicist, was the principal speaker. Richard Courant, professor of mathematics at NYU, is the scientific director of the institute which has as one of its major facilities a computing center that is equipped with a Univac.

The Swedish Government has appropriated Kr. 1.2 million for the construction of a new 11,000 ft² laboratory for the Institute of Hydraulics at the **Royal University of Technology in Stockholm.** In addition, 26 private and municipal power companies have contributed Kr. 265,000 for instruments and other technical equipment. The laboratory marks the second stage in a large-scale plan of creating a "city of science" of research institutions around the university. B. H. Hellström, an expert on hydraulics, is the director of the institute.

Ground-breaking ceremonies for the **new Hayden Science Building** were held recently at **Brandeis University,** Waltham, Mass. A gift of $500,000 from the Charles Hayden Foundation made this addition possible. The total cost of the three-story, 60,000 ft² structure is expected to exceed $1 million.

## Available Grants and Fellowships

The **Division of Research Grants of the National Institutes of Health** will establish two new study sections, one in biophysics and the other in human embryology, on 1 Jan. 1955. Research applications for review at the first meetings of the two sections *will be accepted until 1 Mar.* The biophysics study section will consider project proposals concerned with molecular biology, particularly from the standpoint of the disciplines of physics, physical chemistry, colloid chemistry, and protein chemistry. F. O. Schmitt of Massachusetts Institute of Technology will serve as chairman of the group, and Irvin Fuhr of the NIH Division of Research Grants as executive secretary.

The human embryology and development study section will review research proposals concerned with such problems in human reproduction as infertility, pregnancy and labor, congenital malformations, and the newborn, especially the premature. Louis Hellman, of the State University of New York, New York City, has been named chairman, and Elsa O. Keiles, Division of Research Grants, executive secretary.

The establishment of these two new sections will bring the total number of study sections in the Research Grants Division of NIH to 19.

The department of biochemistry at the **University of Washington** announces the availability of several predoctoral fellowships for 1955–56. These offer stipends of $135/mo for the academic year, and remission of tuition and laboratory fees. Fellows are also eligible for full-time research assistantships during the summer months. Applications should be addressed to the Executive Officers, Dept. of Biochemistry, University of Washington, Seattle 5, Wash.

The **Fund for the Advancement of Education,** established by the Ford Foundation, is offering approximately 150 faculty fellowships for 1955–56 to college teachers throughout the United States. The fund hopes through these fellowships to strengthen college teaching in the liberal arts and to stimulate widespread consideration of the purposes, the means, and the ends of liberal education.

To a greater extent than in previous years the applicant's proposed program will be judged on the basis of its potential contribution to the strengthening of his institution's program of liberal education. Furthermore, related applications from two or more members of one faculty will be considered. As in the past, the awards will be made to able younger teachers throughout the country who wish to broaden their qualifications for teaching within a program of liberal education. Efforts will be made to seek out those teachers having the greatest possibility for growth and development rather than those who have already achieved recognized prominence in their fields.

Fellowships are available in the humanities, the social sciences, and the natural sciences but not in technical or professional subjects. The fellowship program is not intended to provide for the completion of doctorate study, or for the support of private and individual research projects.

Each fellowship provides a grant approximately equivalent to the salary of the recipient at the time of application, and certain expenses in addition. Candidates should be men and women between the ages of 30 and 45 who have been teaching steadily for several years, and each must be nominated by his institution. An institution of less than 600 undergradu-

ates may nominate not more than two candidates; institutions with 600 to 1500 undergraduates may nominate not more than three; and institutions with more than 1500 may nominate not more than four candidates. In each case, the institution nominating a candidate must agree to continue the recipient in his teaching career in 1956–57. It is expected that each fellow will return to his sponsoring institution for at least 1 yr.

Application forms and full information concerning this program are being distributed to the presidents of all colleges and universities in the United States. *Applications must be submitted by 31 Jan. 1955* and announcement of the awards will be made on or about 15 April. Application forms and further information may also be obtained from the Committee on Faculty Fellowships, Fund for the Advancement of Education, 655 Madison Ave., New York 21.

## Grants and Fellowships Awarded

Recent **AAAS research grants** are as follows:

Oklahoma Academy of Science to W. C. Greer, Oklahoma A. & M. College. Effects of sewage pollution on Stillwater Creek.

Hawaiian Academy of Science to M. E. Smith, Honolulu. Relationship between word variety and mean letter length of words and their relationship to chronologic and mental age.

Hawaiian Academy of Science to R. N. Akamine, Honolulu. Carbohydrate-protein complexes in cartilage autografts and homografts.

Indiana Academy of Science to J. Wood. Plant fossils to be found in the Smithsonian Institution.

Indiana Academy of Science to W. Welch. Monographic study of Hookeriaceae.

Kansas Academy of Science to H. H. Hopkins, Fort Hays Kansas State College. Bibliography of the vegetation of Kansas.

The **Rockefeller Foundation** made the following scientific grants during the third quarter of 1954:

University of Natal, Union of South Africa. To institute a department of family practice, 5 yr, $127,000.

Royal Technical College, Glasgow. Postgraduate training and research program in environmental control engineering, 5 yr, $82,000.

Pasteur Institute, Paris. Dept. of Biochemistry, J. Monod, director. Research equipment, $50,000.

University of Edinburgh. J. P. Kendall and E. I. Hirst, chemistry. Research in the field of the natural high ploymers, 5 yr, $45,000.

University of Pavia, Italy. G. Frizzi and C. Jucci, zoology. Chromosomes in the salivary glands of anopheline mosquitoes, 3 yr, $22,000.

Marine Biological Association Laboratory, Plymouth, England. Fundamental research in marine biology, $30,000.

National Nursing Accrediting Service. To bring nursing schools of the U.S. up to standards of full accreditation, 3 yr, $63,771.

Strangeways Research Laboratory, Cambridge, England. Purchase of electron microscope, $30,000.

University of London. J. T. Randall, biophysics. Application of physical techniques to biological problems. 3 yr, $30,000.

Gordon Research Conference of the AAAS. To finance visits of foreign scientists to the U.S., 3 yr, $30,000.

Royal Institution of Great Britain and Davy Faraday Research Laboratory. Structure of proteins, 2 yr, $15,000.

Birmingham University, England. M. Stacey. Research in chemistry of carbohydrates, $15,000.

University of California (Berkeley). Extension Division. To establish a certificate course in medical care administration, $7000.

University of California (Berkeley). H. E. Jones, child welfare. Visit to social science research and training centers in Europe, $880.

Johns Hopkins University. G. O. Gey, cellular pathology. Visit to European laboratories conducting work in cell research and virology, $500.

Inter-American Society of Soils Scientists. Meetings of the society for period ending 31 Mar. 1956, $10,000.

Massachusetts Medical Society. To continue an educational program for the practising physician, $7500.

University of Arizona. Conference on cloud physics research, $5000.

New York University–Bellevue Medical Center. Books on sanitation, public helath, and preventive medicine as a memorial to General W. C. Gorgas, $5000.

University of Puerto Rico. D. M. Q. Negron, nursing education. Visit to nursing centers in the United States, $1300.

University of Puerto Rico. G. Arbona, preventive medicine and public health. Observation of U.S. medical and hospital care programs, $800.

Commonwealth of Puerto Rico. O. Costa-Mandry, pathology and medical education. To observe U.S. regionalization programs, $350.

McGill University, Montreal. Preparation for the 10th International Congress of Genetics, $3500.

University of Liège, Belgium. C. Liébecq. Research in carbohydrate chemistry, $1000.

University of Paris. B. Ephrussi. Research in chemical genetics, $2200.

Karolinska Institute, Stockholm. F. S. Sjöstrand, anatomy. Toward purchase of electron microscope, $6000.

University of Geneva, Institute of Physiology. J. Posternak. Equipment, $5000.

University of Glasgow, Scotland, Conferences of European scientists on genetical problems. $7500.

University of Aberdeen, Scotland. Equipment to be used in general biochemical research, $7200.

University of St. Andrews, Scotland. Equipment for research in marine biology, $2000.

West Africa Yellow Fever Service: Virus Research Institute, Lagos, Nigeria. Air conditioning equipment, $895.

Christian Medical College, Ludhiana, India. C. E. Taylor, preventive medicine. Promotion of preventive medicine teaching and investigations, $8500.

Medical College, Indore, India. J. C. Sachdev, physiology. Equipment, $5500.

Lady Hardinge Medical College, New Delhi, India. S. Padmavati. Equipment and supplies for cardiology unit, $4000.

Medical College Hospital, Patna, Bihar, India. U. N. Shahi, chest surgery. Equipment, $4000.

Nilratan Sircar Medical College, Calcutta, India. S. K. Chatterjee, thoracic surgery. Equipment, $4000.

Medical College Hospital, Trivandrum, Travancore-Cochin, India. R. T. Kesavan Nair. To observe trends in surgery and in medical and nursing education in the U.S. and Great Britain, $3950.

Medical College, Baroda, India. A. N. DeQuadros. Visit to U.S. medical centers, $3850.

Christian Medical College, Vellore, India. L. R. Allen. To promote preventive medicine teaching and investigation, and develop village medical services, $3700.

Medical College, Amritsar, India. Y. Sachdeva. Chest surgery equipment, $3200.

Government of India. R. A. Kaur, minister of health. Visit to U.S. medical centers and public health agencies, $2600.

Indian Council of Medical Research, New Delhi, India. C. G. Pandit. Visit to medical centers and government health agencies in the U.S. and Puerto Rico, $1700.

Institute of Public Health, Tokyo. Department of Microbiology. Application of tissue culture methods to the study of viruses, $2000.

Institute of Public Health, Tokyo. Y. Koya. Observation of teaching of public health and preventive medicine in the U.S., $1900.

Kyushu University Medical School, Fukuoka City, Japan. H. Mizushima, hygiene and public health. Observation of teaching of public health and preventive medicine in the U.S., $1900.

Kyoto University, Japan. K. Onodera. Research in carbohydrate chemistry at Ohio State University, $2000.

Ministry of Health and Welfare, Tokyo. M. Kaneko, nursing section. To observe nursing and midwifery programs in Europe, $900.

Republic of Korea. Purchase of medical and public health publications for selected institutions, $5000.

Seoul National University Medical School, Korea. S. W. Shim, preventive medicine. To observe teaching of preventive

medicine and public health in the Philippines and Japan, $1550.

University of the Philippines, Quezon City. J. S. Salcedo, Jr., chemical hygiene and nutrition. To observe developments in biochemistry and nutrition in Europe and the U.S., $3000.

University of Minas Gerais, Belo Horizonte, Brazil. J. B. Sumner, biochemistry. Equipment, $5000.

University of São Paulo, Brazil. J. L. Pedreira de Freitas, hygiene and preventive medicine. Visit to departments of preventive medicine in the U.S. and South America, $3250.

University of Rio Grande do Sul, Pôrto Alegre, Brazil. Establishment of Casimiro Tondo as director, Institute of Biophysics Research, $1000.

Ministry of Agriculture, State of Rio Grande do Sul, Brazil. Equipment for investigation in soil physics, $525.

Ministry of Agriculture, Santiago, Chile. R. Cortes, entomologist. Visits to agricultural research centers in entomology in Latin America and the U.S., $3350.

University of Chile, Santiago. E. Thiermann. Visit to the National Institutes of Health, Bethesda, Md., $500.

Ministry of Agriculture and Animal Industry, Mexico City. J. Loredo, Federal Extension Service. Visit to the U.S. Department of Agriculture and various state extension service centers, $1200.

Ministry of Agriculture and Animal Industry, Guadalajara, Mexico. R. Palacios. Visit to U.S. agricultural research centers, $975.

University of San Marcos, Lima, Peru. Faculty of Veterinary Medicine for project with Ministry of Agriculture on the study of diseases of the alpaca under M. Moro, $7300.

*Fellowships*

Y. Acosta-Sanchez, Central de Asistencia Social, Lima, Peru. Nursing education, Canada.

A. M. Akman, Refik Saydam Central Inst. of Hygiene, Ankara, Turkey. Bacteriology, U.S.A.

O. Andersen, Rural Univ. of Minas Gerais, Viçosa, Brazil. Agriculture-horticulture, U.S.A.

K. Aras, Univ. of Ankara, Turkey. Biochemistry, Canada.

M. I. Ardao, Inst. of Investigations of Biological Sciences, Montevideo, Uruguay. Experimental biology-biochemistry, U.S.A.

J. Baddiley, Lister Inst., London. Biochemistry-enzymes, U.S.A.

V. Balagopal Raju, Univ. of Madras, India. Pediatrics, U.S.A.

S. Bang, Ministry of Health, Seoul, Korea. Public health, U.S.A.

J. Barún, Univ. of San Marcos, Lima Peru. Agriculture-veterinary biochemistry, U.S.A.

J. M. Borgoño Dominguez, Jefatura Sanitaria Provincial, Santiago, Chile. Epidemiology, U.S.A.

J. M. N. Boss, Middlesex Hospital Medical School, London. Cytology, U.S.A.

A. Campos Tierrafria, Office of Special Studies, Mexico City. Agriculture-plant parasitology, U.S.A.

C. Cardona A., National Univ. of Colombia and Ministry of Agriculture, Medellín. Agriculture-plant parasitology, U.S.A.

L. L. Cavalli-Sforza, Istituto Sieroterapico Milanese and Univ. of Parma, Italy. Biology-chemical genetics, U.S.A.

J. P. L. Cazeneuve, Centre National dela Recherche Scientifique, Paris. Social anthropology, U.S.A.

V. Contreras Vilu, San Borja Hospital, Santiago, Chile. Rheumatoid diseases, U.S.A.

J. Cookson, Univ. of Edinburgh, Scotland. Child psychology, U.S.A.

F. Cornet (France) World Health Organization. Public health nursing and nursing education, Canada.

F. A. Couto, Escola Superior de Agric. Viçosa, Brazil. Agriculture-horticulture, U.S.A.

G. G. Duarte, Univ. of São Paulo, Brazil. Biostatistics, U.S.A.

K. C. Dube, Mental Hospital and Medical College, Nagpur, India. Psychiatry, U.S.A.

J. E. Dutra de Oliveira (Brazil), Vanderbilt Univ. Nutrition, U.S.A.

R. E. Egli, Inst. of Industrial Hygiene & Physiology of Effort, Zurich, Switzerland. Industrial medicine, U.S.A.

J. Fadel-Khoury, Syrian Univ. Hospital, Damascus. Nursing education, U.S.A.

G. E. Fogg, Univ. of London. Biochemistry-photosynthesis, U.S.A.

J. R. J. Freire, Secretariat of Agriculture, Pôrto Alegre, Brazil. Agriculture-microbiology, U.S.A.

C. Garces Orjuela, National Univ. of Colombia, Medellín. Biology, agriculture-plant parasitology, U.S.A.

K. G. Grell, Max Planck Inst. for Biloogy, and Univ. of Tubingen, Germany. Biology-protozoology, U.S.A.

C. T. Gurson, Univ. of Istanbul, Turkey. Pediatrics, U.S.A.

W. Hamdan, American Univ. of Beirut, Lebanon. Nursing education, U.S.A.

M. Hashimoto, Toyonaka Health Center, Osaka, Japan. Public health administration, U.S.A.

H. J. Hubener, Univ. of Frankfurt, Germany. Biochemistry, U.S.A.

Y. Inoue, Fukuoka Prefectural Public Health Nursing School, Fukuoka City, Japan. Public health nursing, U.S.A.

L. Izquierdo, Catholic Univ. of Chile, Valparaiso. Embryology, Belgium.

T. Kamiya, Fukui Prefectural School of Nursing, Fukui City, Japan. Nursing education, U.S.A.

S. R. Kapoor, King George's Medical College, Lucknow, India. Experimental physiology, U.S.A.

P. C. Karli, Univ. of Strasbourg, France. Biology, U.S.A.

H. Kato, Kyoto Univ., Japan. Social psychology, U.S.A.

R. R. A. F. Kehl, Univ. of Marburg/Lahn, Germany. Medicine, U.S.A.

Y. Kobayashi, Inst. of Public Health, Tokyo. Architectural hygiene, U.S.A.

A. G. Kunjamma, School of Nursing, Trivandrum, India. Nursing education, U.S.A.

E. L. Lima, Conselho Nacional de Pesquisas, Brazil. Mathematics, U.S.A.

F. K. Ludwig (Germany), Univ. of Paris. Pathology, U.S.A.

A. Marthinsen, Univ. of Oslo, Norway. Social medicine, U.S.A.

A. Matallana (Colombia), Harvard Univ. Pharmacology, U.S.A.

D. M. McLean, National Health and Medical Research Council, Melbourne, Australia. Virology, U.S.A.

F. Megale, School of Veterinary Science of the State of Minas Gerais, Belo Horizonte, Brazil. Agriculture-veterinary obstetrics, U.S.A.

J. M. Mogey, Univ. of Oxford, England. Sociology, U.S.A.

K. H. Moller (Denmark), World Health Organization. Public health administration, England.

M. I. Narvaez, Office of special studies, Mexico City. Agriculture-plant breeding, U.S.A.

B. K. H. Ochwadt, University of Göttingen, Germany. Physiology, U.S.A.

M. Ohira, Kyushu University, Fukuoka, Japan. Industrial hygiene, U.S.A.

J. E. Orjuela-Navarrete, Ministry of Agriculture and National Center of Agricultural Investigations of Tibaytatá, Bogotá, Colombia. Agriculture-plant parasitology, U.S.A.

B. Palacios Lopez, Ministry of Health, Santiago, Chile. Sanitary engineering, U.S.A.

V. N. Panse, B.Y.L. Nair Charitable Hospital, Bombay, India, Social medicine, U.S.A.

K.-G. Paul, Medical Nobel Inst., Stockholm. Biochemistry-enzymes, England.

J. Pemberton, University of Sheffield, England. Epidemiology, U.S.A.

L. A. Philipps V., Ministry of Agriculture, Lima, Peru. Agriculture-veterinary virology, Chile.

J. N. Pohowalla, King Edward Medical College, Indore, India. Pedintrics, U.S.A.

G. Quievreux, Ecole Professionnelle d'Assistance aux Malades, Paris. Nursing education, U.S.A.

I. Ramirez Araya, Department of Agriculture, Santiago, Chile. Agriculture-plant breeding, Mexico.

L. O. Roberts (England), World Health Organization. Public health, U.S.A.

C. Rodriguez Estrada, Univ. of Guadalajara, Mexico. Physiology and pharmacology, Mexico.

C. Rodriguez Villegas, Ministry of Agriculture, Lima, Peru. Agriculture-animal sterility, U.S.A.

H. Rosado Espinosa, Department of Agriculture, State of Mexico, Toluca. Agriculture-extension methods, U.S.A.

P. M. Sheppard, Oxford Univ., England. Biology-genetics, U.S.A.

L. Sinisterra, Univ. del Valle, Cali, Colombia. Clinical endocrinology and nutrition, U.S.A.

T. Sofue, Univ. of Tokyo. Cultural anthropology, U.S.A.

J. R. Sotelo, Instituto de Investigacion de Ciencias Biologicas, Montevideo, Uruguay. Experimental Biology-cytology, U.S.A.

T. Takatsu, Kyoto University, Japan. Medicine, U.S.A.

A. Tello Garust, University of San Marcos, Lima, Peru. Agriculture-poultry pathology, Chile.

T. Thomas, Christian Medical College and Hospital, Vellore, India. Thoracic surgery, U.S.A.

K. Toyokawa, Univ. of Tokyo. Microbiology, U.S.A.
T. Usui, Institute of Public Health, Tokyo. Public health statistics, U.S.A.
H. C. Varma, King George's Medical College, Lucknow, India. Anatomy and embryology, U.S.A.
V. M. Vega, Ministry of Agriculture, Bogotá, Colombia. Agriculture-soils science, U.S.A.
A. Velez-Gil, Surgical Clinic, Cali, Colombia. Surgery, U.S.A.
E. V. B. Vianna, Univ. of Brazil, Rio de Janeiro. Experimental biology-mathematical genetics, U.S.A.
O. L. Wade, Birmingham Univ., England. Hematology, U.S.A.
K. W. W. H. Walton, Birmingham, Univ., England. Pathology, U.S.A.
T. Weis-Fogh, Univ. of Copenhagen, Denmark. Biology-physiology, England.
J. F. Wilkinson, Univ. of Edinburgh, Scotland. Biochemistry-microbiology, U.S.A.
P. R. Wölen, Health Service of Norway, Oslo. Public health administration, U.S.A.
J. W. Wright (U. of S.A.), World Health Organization. Environmental sanitation, U.S.A.
K.-M. Yao, Department of Reconstruction, Taipeh, Taiwan. Sanitary engineering, U.S.A.
E. W. Yemm, Bristol Univ., England. Biochemistry-microbiology, U.S.A.
M. Yudelevich Kachenowsky, Corporacion de Fomento, Santiago, Chile. Agriculture-forestry, U.S.A.

During 1954 the **Explorers Club** has made grants from its Exploration Fund to the following persons: James P. Chapin, curator emeritus of the American Museum of Natural History, to continue work on the birds of the Belgian Congo at the Belgian IRSAC research station, Bukavu, Belgian Congo; Theodore P. Bank, II, to assist the Bering Sea-Aleutian Expedition of the University of Michigan, which has conducted archeologic and ethnologic investigations in the areas of the Alaskan coast and the Aleutians; S. Dillon Ripley, research associate at the Peabody Museum of Yale University, to pursue ornithologic studies in Netherlands New Guinea; Lorus Milne, professor of biology at the University of New Hampshire, to study the light-receptor organs of certain animals in the jungles of Central America. The Exploration Fund Committee consists of Alexander Wetmore of the Smithsonian Institution, Charles Hitchcock of the American Geographical Society, and Samuel Stein, Charles R. Vose, James A. Allis, and Serge A. Korff (chairman) of New York University.

The following grants and fellowships are listed in the annual report for 1953–54 of the **Life Insurance Medical Research Fund**, New York.

*Grants*

Harvard Medical School. Eric G. Ball. Sources of cardiac energy, 1950–56, $32,300.
University of Washington School of Medicine. H. Stanley Bennett. Fine structure of heart and vessels, 1950–56, $39,835.
Medical College of Alabama. Richard J. Bing. Metabolism of the human heart, 1952–55, $24,014.
Western Reserve University School of Medicine. Gerhard A. Brecher. Dynamic aspects of blood flow, 1947–55, $53,400.
State University of New York Medical Center at New York City. Chandler McC. Brooks. Excitatory process of the heart, 1951–56, $18,518.
University of Pennsylvania Graduate School of Medicine. Julius H. Comroe, Jr. Capillary blood volume of the lungs, 1952–56, $40,320.
Columbia University College of Physicians and Surgeons. Zacharias Dische. Regulation of heart metabolism, 1950–55, $26,800.
Massachusetts General Hospital. John Gergely. Contractile proteins of heart muscle, 1953–55, $10,800.
Vanderbilt University School of Medicine. Margaret E. Greig and William C. Holland. Permeability and enzyme activity of heart tissue, 1950–54, $20,670.
Medical College of Georgia. W. F. Hamilton. Blood pressure and blood flow, 1946–56, $81,080.
University of Wisconsin Medical School. John W. Harman. Role of mitochondria in heart respiration, 1950–56, $36,660.
University of Utah College of Medicine. Hans H. Hecht. Physiology of single heart muscle fibers, 1951–55, $22,775.
Western Reserve University School of Medicine. Normand L. Hoerr. Circulation in small blood vessels, 1948–54, $60,150.
State University of Iowa College of Medicine. Steven M. Horvath. Cardiovascular reactions to stresses, 1950–53, $21,945.
University of Washington School of Medicine. Frank M. Huennekens. Metabolism of one-carbon units, 1954–56, $8800.
University of Washington School of Medicine. Rex. L. Huff and David D. Feller. Blood volume and body density 1953–55, $14,040.
University of Wisconsin Medical School. Henry A. Lardy. Intermediary metabolism, 1951–55, $31,980.
University of Minnesota Medical School. Nathan Lifson. Exchange of materials across capillary walls, 1952–54, $16,200.
Massachusetts General Hospital. Fritz Lipmann. Enzyme mechanisms in biosynthesis, 1953–55, $30,240.
University of North Carolina School of Medicine. A. T. Miller. Metabolic studies of obesity, 1954–56, $13,200.
Western Reserve University School of Medicine. W. F. H. M. Mommaerts. Chemical phenomena in heart activity, 1953–55, $10,800.
Vanderbilt University School of Medicine. Elliot V. Newman. Theory and use of dye dilution principle, 1952–55, $24,450.
Harvard School of Public Health. Stanley J. Sarnoff. New evaluation of Starling's Law, 1953–55, $14,580.
Harvard School of Public Health. Fredrick J. Stare. Nutritional deficiencies and cardiac metabolism, 1948–54, $42,210.
Duke University School of Medicine. Eugene A. Stead, Jr. Cardiovascular and respiratory physiology, 1946–56, $130,240.
University of Rochester School of Medicine and Dentistry. Elmer H. Stotz. Heart metabolism, 1950–56, $28,260.
California Institute of Technology. A. van Harreveld. Fetal circulation, 1952–54, $10,585.
University of Minnesota Medical School. Maurice B. Visscher. Cardiovascular and renal physiology, 1946–54, $83,585.
Tulane University School of Medicine. Walter S. Wilde. Sequence of chemical and physical events, 1952–55, $19,440.
Harvard Medical School. A. Clifford Barger. Development of heart failure, 1951–56, $23,492.
University of Oregon Medical School. William D. Blake. Regulation of kidney function, 1950–56, $28,860.
Woman's Medical College of Pennsylvania. Phyllis A. Bott. Electrolyte excretion by kidney units, 1952–55, $14,670.
Emory University School of Medicine. H. D. Bruner. Lymph flow from the kidney, 1954–56, $17,600.
Johns Hopkins University School of Medicine. Francis P. Chinard. Passage across capillary walls, 1950–56, $44,775.
Harvard Medical School and Peter Bent Brigham Hospital. Lewis Dexter. Circulation in the lungs, 1947–56, $91,700.
New York University-Bellevue Medical Center. David P. Earle. Body fluids and kidney function, 1947–55, $66,150.
New York University-Bellevue Medical Center. Ludwig W. Eichna. Venous congestion, 1951–55, $33,030.
Saint Louis University School of Medicine. C. Rollins Hanlon. Vascular obstruction in the lungs, 1953–55, $14,040.
Medical College of Alabama. Tinsley R. Harrison. Regulation of salt excretion, 1951–55, $29,880.
Temple University School of Medicine. Mary Ellen Hartman. Vascular responses in the kidney glomerulus, 1954–56, $4180.
Western Reserve University School of Medicine. Walter Heymann. Kidney Disease in children, 1947–54, $55,890.
University of California School of Medicine. John H. Lawrence. Total body water, 1947–53, $33,075.
University of Cincinnati College of Medicine. William D. Lotspeich. Production and excretion of ketone bodies, 1952–55, $28,080.
University of Pennsylvania School of Medicine. Hugh Montgomery. Arterial oxygen in cardiac patients, 1951–54, $21,240.
Long Island College of Medicine, Hoagland Laboratory, Brooklyn and Overlook Hospital, Summit, New Jersey. Jean Oliver. Structural and functional aspects of kidney activity, 1948–57, $37,550.
University of Pittsburgh Graduate School of Public Health. Roebrt E. Olson. High output heart failure, 1953–56, $24,840.
Cornell University Medical College. Robert F. Pitts. Regulation of acid-base balance 1950–57, $46,860.

Johns Hopkins University School of Medicine. Richard S. Ross. Plasma volume in congestive failure, 1954–56, $10,230.

University of Wisconsin Medical School F. E. Shideman. Transport of sodium by kidney tubules, 1951–55, $23,022.

University of Pennsylvania School of Medicine. William C. Stadie. Disturbances in acid-base balance, 1951–54, $7980.

University of Texas Medical Branch. H. G. Swann. Interstitial pressure in the kidneys, 1953–55, $13,824.

University of Wisconsin Medical School. William B. Youmans. Decreased peripheral resistance, 1953–55, $11,664.

University of Southern California School of Medicine. Hans H. Zinsser. Glomerular elastic constants, 1952–54, $16,740.

University of Michigan Medical School. David F. Bohr. Humoral factors in hypertension, 1950–55, $28,795.

University of Western Ontario Faculty of Medicine. Alan C. Burton. Behavior of small blood vessels, 1947–55, $46,530.

University of California School of Medicine, Los Angeles. William G. Clark. Metabolism of pressor amines, 1951–55, $30,310.

Stanford University School of Medicine. J. M. Crimson. Capillary blood flow, 1949–54, $23,185.

University of Cincinnati College of Medicine and Emory University School of Medicine. Eugene B. Ferris, Jr., and M. A. Blankenhorn. Hypertensive disease, 1950–55, $32,880.

Washington University School of Medicine. Robert F. Furchgott. Activity of smooth muscle, 1950–56, $33,660.

Hotel-Dieu Hospital, Montreal. Jacques Benest. The sodium-retaining hormone, 1953–55, $10,800.

Duke University School of Medicine. Philip Handler. Humoral relationships in hypertension, 1946–55, $75,405.

Howard University College of Medicine. Edward W. Hawthorne. Cortical ablation and renal hypertension, 1954–56, $16,830.

Northwestern University Medical School. Paul Kezdi. Regulation of presso-receptor activity, 1954–56, $7480.

State University of New York Medical Center Syracuse. Gordon K. Moe. Autonomic blocking agents, 1951–56, $29,112.

Mount Zion Hospital, San Francisco. Ray H. Rosenman. Potassium and blood pressure, 1952–55, $24,450.

Washington University School of Medicine. Henry A. Schroeder. Amino acid metabolism, 1952–55, $18,470.

Vanderbilt University School of Medicine. John B. Youmans. Long-term high dietary sodium chloride, 1954–56, $15,620.

New York University. Benjamin W. Zweifach. Behavior of peripheral blood vessels, 1953–55, $10,692.

Harvard University. Konrad Bloch. Biosynthesis of Cholesterol, 1954–57, $20,700.

University of California School of Medicine. I. L. Chaikoff. Development of arteriosclerosis, 1947–56, $92,025.

Columbia University College of Physicians and Surgeons. Erwin Chargaff. Substances active in blood clotting, 1949–55, $43,980.

Tulane University School of Medicine. Emmanuel Farber. Degenerative changes in tissues, 1953–55, $10,800.

University of Washington School of Medicine. T. Lloyd Fletcher. Changes in vascular grafts, 1953–55, $8524.

Mount Zion Hospital, San Francisco. Meyer Friedman. Control of blood cholesterol, 1953–55, $17,280.

University of California School of Medicine. John W. Gofman. Lipoproteins and arteriosclerosis, 1951–55, $42,060.

University of California School of Medicine. David M. Greenberg. Metabolism of cholesterol, 1953–55, $14,580.

University of Washington School of Medicine. Donald J. Hanahan. Ergosterol metabolism, 1953–55, $10,800.

Louisiana State University School of Medicine. Russell L. Holman. Experimental arterial disease, 1949–54, $41,758.

University of Saskatchewan School of Medical Sciences. L. B. Jaques. Heparin and thrombosis, 1949–54, $19,575.

University of Kansas. Kenneth E. Jochim. Circulatory changes in arteriosclerosis, 1953–55, $8316.

Mount Sinai Hospital, New York. Paul Klemperer. Connective tissue, 1949–55, $37,992.

University of Chicago. Division of the Biological Sciences. M. E. Krahl. Lipoproteins as regulators of metabolism, 1954–56, $19,800.

University of California School of Medicine at Los Angeles. N. B. Kurnick. Desoxyribonuclease, 1952–55, $17,280.

State University of New York Medical Center at Syracuse. John M. McKibbin. Essential tissue lipids, 1946–55, $56,406.

University of Chicago, Division of Biological Sciences. Henry T. Ricketts. Vascular disease and diabetes, 1952–54, $10,800.

Columbia University College of Physicians and Surgeons. Beatrice Carrier Seegal. Experimental vascular disease, 1952–56, $27,240.

University of Vermont College of Medicine. Durwood J. Smith. Vessels of arterial walls, 1953–55, $12,960.

Harvard School of Public Health. Fredrick J. Stare. Relation of sulfur metabolism of arteriosclerosis, 1954–56, $26,400.

Yale University School of Medicine. Levin L. Waters. Development of arteriosclerosis, 1949–55, $42,360.

Western Reserve University School of Medicine. Harland G. Wood. Propanediol phosphate in metabolism, 1952–56, $39,240.

University of Tennessee College of Medicine. Donald B. Zilversmit. Deposition and mobilization of arterial lipids, 1951–55, $18,984.

New York University College of Dentistry. Marjorie B. Zucker. Blood coagulation, 1950–53, $9570.

Washington University School of Medicine. Robert J. Glaser. Streptococcal infections and rheumatic fever, 1949–55, $44,925.

University of Utah College of Medicine. Vincent C. Kelley. Pituitary-adrenal system, 1952–55, $32,600.

Tulane University School of Medicine. Edwin D. Kilbourne. Viral myocarditis, 1954–56, $20,900.

New York University-Bellevue Medical Center. Colin M. MacLeod. Streptococcal products, 1946–56, $117,697.50.

Vanderbilt University School of Medicine. Robert W. Quinn. Response to streptococcal antigens, 1954–56, $8800.

Western Reserve University School of Medicine. A. B. Stavitsky. Antibody formation and hypersensitivity, 1954–56, $15,400.

Washington University School of Medicine. W. Barry Wood, Jr. Cellular physiology of inflammation, 1952–56, $58,840.

University of Minnesota Medical School. Ivan D. Baronofsky. Problems basic to heart surgery, 1953–55, $16,200.

Yale Unviersity School of Medicine. D. D. Bonnycastle. Plasma constituents which improve heart action, 1951–54, $10,500.

Stanford University School of Medicine. Emile Holman. Basic studies for cardiovascular surgery, 1949–55, $52,835.

State University of New York Medical Center at New York City. Clarence Dennis. Surgical repair of congenital anomalies, 1953–55, $21,600.

University of Chicago, Division of the Biological Sciences. E. M. K. Geiling. Metabolism and action of heart drugs, 1947–55, $64,134.

University of Minnesota Medical School. C. Walton Lillehei. Intracardiac surgery under direct vision, 1954–56, $9900.

Johns Hopkins University School of Medicine. E. K. Marshall, Jr. Cinchoninic acid derivatives, 1949–54, $36,390.

University of Vermont College of Medicine. R. J. McKay, Jr. Age differences in the heart, 1951–54, $2330.

Columbia University College of Physicians and Surgeons. Andre Cournand. Heart action-effects of treatment, 1954–56, $20,900.

University of Pennsylvania School of Medicine. Carl F. Schmidt. Drug effects on the heart, 1946–56, $101,350.

Johns Hopkins University School of Medicine. Samuel A. Talbot. Ballistocardiography, 1952–56, $33,780.

University of Puerto Rico School of Medicine. David B. Tyler. Effects of drugs on heart metabolism, 1953–55, $11,448.

University of Southern California School of Medicine. John Leyden Webb. Cellular actions of cardiovascular drugs, 1946–55, $95,745.

*Fellowships, 1954–55*

Irwin A. Almenoff, University of Minnesota Medical School. Histo- and cytochemical techniques.

Robert W. Chambers, University of British Columbia. Purification and structural determination of hypertension.

Morley Cohen, University of Minnesota Medical School. Methods of intracardiac surgery.

Sherold Fishman, University of Pennsylvania School of Medicine. Intermediary metabolism with reference to arteriosclerosis.

Eugene J. Gangarosa, University of Rochester School of Medicine and Dentistry. Streptococcal hypersensitivity.

Thomas O. Gentsch, Yale University School of Medicine. Effects of hypervolemic stress on arterial grafts.

Jack Peter Green, Danmarks Tekniske Hojskole, Copenhagen. The mechanism of action of dicumarol and vitamin K.

Warren R. Guild, Peter Bent Brigham Hospital, Boston. Combined heart and kidney disease.

Edward C. Heath, Purdue University. Glucose metabolism in Penicillium chrysogenum.

John B. Lyon, Emory University School of Medicine. The role of insulin and anti-insulin factors in metabolism.

William P. McCann, Johns Hopkins University School of Medicine. Drug and hormone effects on kidney enzyme systems.

Donald M. Pitcairn, Harvard Medical School. Cardiovascular adjustments in pregnancy.

Oscar W. Portman, Harvard School of Public Health. New preparation for evaluation of the cholesterol cycle.

Roy Elliot Ritts, Jr., Peter Bent Brigham Hospital, Boston. Tissue reactions in bacterial allergy.

Stanley N. Rokaw, Harvard Medical School. Experimental pulmonary disease and the pathogenesis of cor pulmonale.

David Schachter, Columbia University College of Physicians and Surgeons. Biochemical nature of renal tubular transport.

Herbert O. Sieker, Duke University School of Medicine. Retinal vessels in normal subjects and in patients.

Henry Stude, Jr., Yale University School of Medicine. Effects of cardiac glycosides on myocardial excitability.

Donald F. Tapley, Johns Hopkins University School of Medicine. Hormonal control of intermediary metabolism.

Leonard Warren, Massachusetts Institute of Technology. Synthesis of nucleic acids in animal tissues.

Henry O. Wheeler, Columbia University College of Physicians and Surgeons. Delay in the passage of blood through the splanchnic systems.

T. Franklin Williams, University of North Carolina School of Medicine. Mechanisms that suppress antidiuretic and antisaluretic stimuli.

Francis E. Yates, Harvard Medical School. Renal excretion of electrolytes and water in heart failure.

Norman L. Carden, University of Wisconsin Medical School. Pharmacology.

Benjamin G. Covino, Boston University School of Medicine. Physiology.

Barbara A. Drake, Stanford University. Study in biochemistry.

Franklin M. Harold, University of California School of Medicine. Physiology.

Harold O. Kammen, Stanford University. Biochemistry.

Cyril Max Kay, Harvard University. Physical chemistry.

Norman B. Marshall, Harvard School of Public Health. Nutrition.

Marilyn Wales McCaman, Washington University School of Medicine. Pharmacology.

Leonard M. Napolitano, Saint Louis University School of Medicine. Neuroanatomy.

Carl F. Rothe, Ohio State University Graduate School. Physiology.

Norman Strauss, University of California School of Medicine. Bacteriology.

Maria-Michaela Smits Thompson, Harvard Medical School. Biochemistry.

Samuel I. Yamada, University of Western Ontario Faculty of Medicine. Biophysics.

## Instruments

A variable speed model of Eberbach's light duty **laboratory stirrer**, the "hollow spindle" Lab-Stir, is now available. A rheostat permits continuous stirring at speeds from 100 to 1550 rev/min under load. (Eberbach Corp., Bull. 440 X-54, Dept. Sc., Ann Arbor, Mich.)

Model 515 Alphatron **vacuum gage** indicates pressures from 0.001 to 10 mm-Hg. The pressure is read from a single four-decade logarithmic scale. The instrument utilizes a sealed radium source that emits alpha particles and produces ionized gas molecules which are collected on a plate to produce a current proportional to the pressure. (Naresco Equipment Corp., Dept. Sc., 160 Charlemont St., Newton Highlands 61, Mass.)

Fast, simple projection of true-color microscope specimens for group study is made possible by a new **microprojector.** The instrument has a prealigned optical system with four turret-mounted objective lenses. Correct spacing of the carbon electrodes in the arc illuminator is maintained automatically, and viewing time is 1 hr or more per set of carbons. Magnification range is 30 to 3000x at a projection distance of 12 ft. (Bausch and Lomb Optical Co., Catalog E-246, Dept. Sc., 635 St. Paul St., Rochester 2, N.Y.)

An **isotope analyzer** designed to perform rapid and accurate qualitative and quantitative analyses of isotope mixtures containing beta-emitting components has been announced by the Forro Co. The instrument utilizes a technique based on the absorption and scattering of beta rays in elements of high atomic number [*Zeitschrift für Physik* **138**, 441 (1954)]. The analyzer may be operated with any scaling unit having a high voltage power supply and input sensitivity of 0.25 v. Three models, sensitive to activities of $0.2\times10^{-9}$, $1.2\times10^{-9}$, and $4\times10^{-9}$ c, are available. (Forro Scientific Co., Dept. Sc., 833 Lincoln St., Evanston, Ill.)

**Chromatoplat** is a stainless steel platform designed to replace the tripod assembly in 12-in.-diameter chromatographic chambers used for either ascending or descending chromatography. The platform is held in the chamber at any distance from the top by an expanding collar. Two solvent assemblies or simple troughs can be used concomitantly. (Nalge Co., Inc., Dept. Sc., 625 S. Goodman St., Rochester 2, N.Y.)

## In the Laboratories

The **Atomic Industrial Forum, Inc.,** New York, has announced the formation of an industrial Nuclear Reactor Materials Committee. Companies cooperating in the organization of the committee are Allegheny Ludlum Steel Corp., Aluminum Co. of America, The Babcock and Wilcox Co., Climax Molybdenum Co., International Nickel Co., Lukens Steel Co., Nuclear Metals, Inc., Republic Steel Corp., Titanium Metals Corp., and Vanadium Corp. of America.

If a zoning change is made, **General Foods** will build a food research center on a 55-acre site in Tarrytown, N.Y. The company has outgrown its present laboratory facilities in Hoboken, N.J. The proposed center will consist of several two-story-and-penthouse buildings that will be air-conditioned and sound proof and that will furnish working space for approximately 600 employees.

The establishment of a new instrument division, as well as a change in the corporate name of the company, has just been announced by the **Nuclear Research and Development Co.,** 6425 Etzel Ave., St. Louis, Mo. The new company name is **Nuclear Consultants, Inc.,** reflecting the medical and industrial consulting service that is a major function of the organization.

The new division, to be known as the NRD Instrument Co., will produce and sell the products that the company previously manufactured only for use in its

consulting activities. In addition, a completely new line of scintillation counting instruments has been developed. The expansion was made necessary by the increasing use of radioisotopes in hospitals and clinics.

A new a-c network calculator has been built by the **Westinghouse Electric Corp.** and put into service at the East Pittsburgh, Pa., plant. The machine is designed to accommodate the largest interconnected systems and power pools in existence today. It has a total of 668 circuit components for representing generators, transformers, transmission lines, and loads. The newest feature is individual load regulation for the 36 generator units.

More than 100 educators, scientists, and petroleum industry leaders participated recently in formal opening ceremonies for the enlarged research laboratory of the **Carter Oil Co.**, Tulsa, Okla. The new building, containing 56 rooms, much new scientific equipment, and a 90-ft drilling research tower where actual drilling operations may be carried on as from a steel derrick, has increased Carter's research facilities by 50 percent. The staff of 220 technicians conducts research relating to oil exploration and production for Carter and other affiliates of the Standard Oil Co. (N.J.).

This year the Parke, Davis and Co. Journal, *Therapeutic Notes*, celebrates its 60th anniversary. The "parent" edition of this journal is sent to approximately 175,000 physicians and allied professional people. Five other editions are published—British, Australian, Spanish, French, and Portuguese—resulting in a circulation of 500,000 and a distribution that reaches every country outside the Iron Curtain.

Plans are under consideration for the construction of a $5,750,000 laboratory for research in nuclear-powered flight. It would be built within a 50-mi radius of East Hartford, Conn., and would be operated by the **Pratt and Whitney Division of the United Aircraft Corp.** under contracts with the Air Force and the Atomic Energy Commission.

Ground has been broken for the **New England Institute for Medical Research** in Ridgefield, Conn. This laboratory is a nonprofit institution supported by private grants and gifts. In addition to physicians in various medical specialties, there will be doctorate personnel in the physical sciences, including nuclear physics, physical chemistry, engineering, electronics, and so forth, as well as personnel in histology, bacteriology, immunology, biochemistry, and radioibiology.

The physical plant will occupy an area of approximately 25,000 ft². A grant has been made for the building of a linear electron accelerator as part of the program for investigation in neoplastic diseases. Clinical facilities will be added in order to make isotopes available to the physicians of the area for both diagnosis and therapy.

## Miscellaneous

A 7-vol. *Patent Abstract Series*, has been announced by the Office of Technical Services of the U.S. Department of Commerce. Important details of more than 4300 Government-owned inventions are given in these extensive pamphlets along with instructions on how to get more information and how to apply for use of the inventions under nonexclusive, royalty-free licenses.

The abstract of each invention presents a clear and concise summary with special reference to unusual features. Construction details are provided for machines, devices, apparatus, and products. The identity of chemical compounds is disclosed. In the case of processes, procedure is described. Other information includes the patent number, the name of the inventor, and the name of the Government agency administering the patent.

The series was prepared by the Government Patents Board from its Index of Inventions. It is published jointly by the Department of Commerce and the Small Business Administration as an encouragement to American industry to take greater advantage of the technical information developed from research financed by the Government. Titles of the publications are as follows: *Instrumentation*, $2; *Chemical Products and Processes*, $3; *Food Products and Processes*, $1; *Metal Processes and Apparatus, Machinery, and Transportation Equipment*, $2; *Electrical and Electronic Apparatus*, $4; *Ordnance*, $2; *Ceramic, Paper, Rubber, Textile, Wood, and Other Products and Processes*, $1.

Price of the complete set is $12. Orders may be placed through the nearest U.S. Department of Commerce field office or may be sent directly to Office of Technical Services, U.S. Department of Commerce, Washington 25, D.C. Make check or money order payable to OTS, Department of Commerce.

The Bureau of Land Management of the Department of the Interior has announced that *The 1955 Ephemeris*, the new edition of the astronomical almanac, may be obtained by sending 25 ct to the Superintendent of Documents, Government Printing Office, Washington 25, D.C. The book contains tables and charts of the positions of major planets and is used in making rectangular surveys of public lands and in mapping and navigation.

Honoring the memory of the late Albert F. Blakeslee, internationally known botanist, geneticist, and director of the Smith College Genetics Experiment Station, the college has announced establishment of the **Albert F. Blakeslee Memorial Fund** to be used to endow a science lectureship. A committee of Blakeslee's associates at Smith, Amherst College, Mt. Holyoke College, and the University of Massachusetts has been formed to raise money to bring distinguished scientists in various fields to Smith to deliver public lectures. Contributions may be sent to the Albert F. Blakeslee Memorial Fund, Smith College, Northampton, Mass.

# Book Reviews

***America's Resources of Specialized Talent.*** A current appraisal and a look ahead. Report of the Commission on Human Resources and Advanced Training; Dael Wolfle, director. Harper, New York, 1954. xvii + 332 pp. Illus. $4.

This book is the report of the study begun in 1949 by the Commission on Human Resources and Advanced Training and financed by the Rockefeller Foundation. Its 332 pages are crammed with valuable and fascinating factual material on the intelligence, education, and utilization of men and women with unusual talents in the sciences, arts, social studies, and other professions.

The purpose of the volume is well summarized in the concluding chapter:

> America is ambivalent toward the scholar. It wants rocket ships and atomic-powered submarines, a cure for cancer and bigger television screens. . . . But it mistrusts the people who have the ability and education that might lead to these desired end products.
>
> These doubts limit the extent to which the nation can capitalize on its intellectual resources and thus limit its progress. but the limitation is unnecessary and can be overcome. . . . The practical problem becomes one of devising the best names of nurturing the talent which lies in the population.

Since 1900, says the report, the number of specialists in the U.S. has grown twice as fast as the population. The demand is certain to increase; and college graduates, who constitute almost the sole supply, will double in number in the next 15 years. This doubling could take place today with no loss of quality if all those in the upper quartile in intelligence could be motivated to go to college—and could afford to do so. The present shortage will have to be filled by better use of existing specialists. In the long run, the greatest hope lies in the early identification and the encouragement of specialized talent.

Dael Wolfle's volume stands as a unique summary of the facts and problems in the whole field of specialized talent. It will be indispensable to the educator, the counselor, and to government and private manpower agencies.

L. A. DuBridge

*California Institute of Technology*

***Fundamentals of Psychoanalytic Technique.*** Trygve Braatøy. Wiley, New York; Chapman & Hall, London, 1954. xi + 404 pp. $6.

Trygve Braatøy was possessed of a clinical intuition which enabled him to give his patients the full benefit of his own thorough training in medicine, psychiatry, and psychoanalysis. This ability to communicate his experience is evident in this book in which, on a base of standard psychoanalytic theory, he describes the application of theory to daily practice and the technical modifications and fresh approaches he has evolved. For the most part, these modifications aim toward the fuller expression of affects related to the body and bodily processes in the analysis and consequently toward furtherance of a unified psychosomatic growth.

Important sections deal with the emotions of the analyst, the indications and analytic contraindications for psychoanalytic therapy and the science of interpretation. Regarding the controversial short-term methods of analysis, Braatøy believes that criticism and mistrust have been too hasty and, had the reported clinical histories been studied, some of the most orthodox analysts would have agreed with the treatment methods advocated.

Throughout the author pleads for taking time in clinical description and in studying the descriptions of others. He avoids dogma in his own teaching and seeks rather to help the student develop his individual art and science, leaving to the student, as to the patient, the last word.

With its fresh approach and its rich originality, Braatøy's book is a contribution to the psychoanalytic literature and will be of great use to students, practitioners, and teachers.

Douglas Noble

*1907 Eye St., NW, Washington, D.C.*

***The Technical Report.*** Its preparation, processing, and use in industry and government. B. H. Weil, Ed. Reinhold, New York, 1954. xii + 485 pp. Illus. $12.

Weil and his 22 collaborators have attempted to put together a handbook on the preparation, processing, and use of technical reports in industry and government. On the whole they have succeeded. There is here much good advice for the report writer, editor, and librarian.

The authors deal mostly with research reports as a means for exchange of scientific information. In a few instances, however, technical reports are treated as active management tools, useful in research direction and planning, production control, market research, personnel administration, and even morale building, that is, the writing of a report lifts the cloak of anonymity from the man on the bench. He is stimulated to do better work and is better satisfied with his job.

At least one-third of the book is devoted to the organization, classification, storage, and retrieval of reports. This is appropriate, for as Vannevar Bush vigorously points out, our inability to make full use of the record is "the region of greatest moment, in which our ignorance and ineptitude are most serious, which will slow down our progress if it continues in its present state."

The authors describe an imposing array of mechan-

ical and clerical aids which suggests that much thought has been given the problem. This is true. The documentalists can point with pride to such heroic reference achievements as the catalogue of the Library of Congress, the decennial index to *Chemical Abstracts*, the U.S. Patent Office classification system, and the many devices, manual and automatic, that now serve the scientist and librarian.

Unfortunately, the automatic features of such aids apply only after the arduous intellectual labor of analysis, classification, indexing or coding is completed. These tasks are semiroutine but by no means semiskilled. They call for scientifically trained, well paid workers and the production rate is agonizingly low.

Some authorities insist that such work will never be relegated to machines, that the human brain will continue to be the central element in the organization and processing of information. This seems unduly pessimistic, but to solve the problem will require scientific thinking of an extraordinarily high level in fields often neglected and by some not considered scientific at all. It will require the combined best efforts of the logicians, information theorists, communications engineers, grammarians, and semanticists, and no doubt others. The need, however, is real and the search will be rewarding.

ROBERT TUMBLESON

*Office of Scientific Information,*
*National Science Foundation*

***The Mechanism of Economic Systems.*** An approach to the problem of economic stabilization from the point of view of control-system engineering. Arnold Tustin, Harvard Univ. Press, Cambridge, Mass., 1953. xi + 161 pp. Illus. $5.

Arnold Tustin, head of the Department of Electrical Engineering, University of Birmingham, explores the relationship that exists between the feed-back mechanism of engineering control systems and the behavior of economic systems. For example, the simplest Keynesian model in which investment is exogenous and consumption is a linear function of income is analogous to an electric generator that is partly but not wholly self-exciting, the closed sequence income-consumption-production-income being analogous to the feed-back of the dynamo. This leads Tustin to suggest that "perhaps in this electrical age, the conventional metaphor of 'priming the pump' might be dropped in favour of 'exciting the dynamo.'" In other words, the rapid progress in the development of automatic control systems (automatic pilots, thermostats, and so forth) in the engineering world may contribute to the solution of problems of economic stabilization.

To demonstrate this a series of economic models, particularly those of Hicks, Kalecki, and Goodwin, are discussed in an attempt to outline the characteristics of a model that will produce fluctuations similar to those observed in the real world. Linear systems are rejected since the oscillations produced by them either explode, die away, or continue with constant amplitude and period. The introduction of erratic shocks (for example, exogenous investment) into the model to explain why the fluctuations continue with varying amplitude and period is not entirely satisfactory since the theory remains incomplete if the shocks are not explained. The conclusion is drawn therefore that economic models must contain both nonlinearities and complex time dependencies. The difficulty of computing the solutions of such systems can be overcome, it is suggested, by constructing physical systems that are analogous to the economic systems under study. A physical analog computer will then produce the results as graphs of the variations of the principal variables. To assist the economist in understanding the properties of engineering systems, over one-third of the book is devoted to a geometric, rather than the usual algebraic, analysis of the behavior of systems in terms of sinusoidal components of variation.

JOHN A. SAWYER

*Research and Development Division,*
*Dominion Bureau of Statistics, Ottawa, Canada*

***Radiation Biology,*** vol. I: *High Energy Radiation,* Parts I and II. Alexander Hollaender, Ed. McGraw-Hill, New York–London, 1954. ix + 1265 pp. Illus. $17.50.

This comprehensive volume, in two parts, deals with the radiation biology of high energy radiations. It is the first of a three-volume set, the latter of which are to deal with ultraviolet and related radiations and visible light. Its 18 chapters have been contributed by authors of national and international reputation for their contributions in the fields with which they individually deal.

The material and the arrangement initially cover the principles of radiologic physics, measurement, and chemical effects of radiation, as well as basic actions on biological systems. These subjects are dealt with in complete and well-organized form and, although much of this material could be obtained from other sources, it is fundamental for the understanding of the later chapters.

The next group of chapters deals with genetic, mutational, and chromosome aberration effects. The authors have rendered a considerable service in bringing a large mass of material into accessible form, documented by excellent bibliographies. As a reference book this has many advantages, but as a textbook it might have been improved by more editorial commentary and reorganization for readibility.

The last group of chapters deals with radiation effects on the group cellular level of pathological physiology, hematology, histology, and carcinogenesis. The considerable amount of work in these fields has been summarized with commendable thoroughness; it suffers largely because of the incompleteness of knowledge in this rapidly changing field rather than from lack of diligence of the authors in trying to include

all the important work current at the time of writing. These chapters particularly will be an extremely valuable reference source to all workers in the field of radiation biology.

This volume is a definitive addition to the libraries of radiobiologists, radiologists, radiological physicists, and a large group of other scientists whose work brings them in contact with the effects of ionizing radiations on living tissues.

RICHARD H. CHAMBERLAIN
*Department of Radiology,*
*University of Pennsylvania Hospital*

***The Horse-Flies (Diptera: Tabanidae) of the Ethiopian Region.*** vol. II: *Tabanus and Related Genera.* H. Oldroyd. British Museum (Natural History), London, 1954. x + 341 pp. Illus. + plates. £2 5s.

Here is a handsomely printed and abundantly illustrated companion volume to the first of the series on another tribe, the Haematopotini, of the same region. The third, to appear later on the entire subfamily Pangoniinae, will complete the series. This outstanding monographic work by a world authority on an important blood-sucking group of insects constitutes a monumental contribution to an understanding of insects of medical and veterinary importance in Africa. It will be the chief reference in its field for many years. The British Museum (Natural History) is to be congratulated for sponsoring this more than ample treatment at a time when printing costs are up and publication of large systematic, faunal studies, even of an important group like this, are more often discouraged than stimulated.

The author brings to bear a wealth of world experience with this family of flies, and integrates the latest refinements in classification with those on other continents. Not since the very inadequate and incomplete work of Surcouf and Ricardo in 1909 has there been available any comprehensive treatment of the complex group of flies related to the genus *Tabanus sens. lat.* for the region. The keys in particular will be welcomed and they appear to be highly practical, supplemented by 238 critical figures of which the author himself has drawn many. There are 31 maps showing distribution of species groups for a total of 147 species, 17 new. For the great majority of these, Oldroyd has studied the types and redescribed fresh specimens, including the males of about half. This was facilitated by the wealth of material uniquely accessible to him in the British Museum and in other collections. It is remarkable that only 8 species of *Tabanus* are deleted from the Ethiopian list as wrongly or doubtfully located, or unrecognizable.

The author discusses previous efforts and difficulties in attempting to break up the "great, unorganized mass of species" in the "all-embracing *Tabanus*" and accomplishes some restriction himself, but further admits that "it is certain that very many of the species included [in his *Tabanus sens. str.*] are not strictly congeneric with *Tabanus bovinus,* and therefore there is little one can say about the group in a positive sense." Three new genera are proposed and four, based on new conceptions and in part on recognition of primitive elements through the bare basicostas on the wings, are raised from previous subgeneric status.

Though the basic purpose of the book is a systematic review, there are introductory discussions of such subjects as morphology, collecting and preserving, early stages and habits, transmission of disease, and phylogeny which make interesting and informative reading for many not particularly interested in taxonomy *per se.* One stated aim in this regard is most admirable: "I have brought together everything I could find in the hope of stimulating more study of the behavior of the living flies, and more collecting and breeding of the larvae and pupae." This volume should certainly stimulate progress in that direction, particularly since a new world of previously supposed rare or unknown tabanids has been opened up incidental to the study of mosquito denizens high up in the jungle canopy.

The considerable upsurge in world-wide interest in the Tabanidae is reflected in the author's references including unpublished studies of Ovazza and Taufflieb on possible discovery of new characters of internal female genitalia. A marked advance in world classification of suprageneric categories is anticipated in the studies of Mackerras of Australia (also in press) on genitalia of both sexes which should integrate nicely with the third Ethiopian volume still to come.

CORNELIUS B. PHILIP
*National Microbiological Institute,*
*Rocky Mountain Laboratory, Hamilton, Montana*

***Ferromagnetic Domains.*** K. H. Stewart. Cambridge Univ Press, New York, 1954. viii + 176 pp. Illus. + plates. $4.75.

A review or monograph inevitably reflects the principal interests of its author. The recent Cambridge monograph, *Ferromagnetic Domains,* is no exception. The author has given an admirable treatment of the phases of the subject with which he has had most intimate association in his research activities. A consequence of this is that the value of this work is to be found not so much in the early chapters devoted to the nature, background, and origin of the domain concept in ferromagnetism and their properties but rather in the treatment of the outward manifestations of their existence in influencing macroscopically measurable material properties. Thus the chapters on time effects in ferromagnetic materials and on hindrances to domain wall motion are a welcome addition to the literature in that they provide a coherent though succinct survey of developments in this direction. By contrast, the early chapters on magnetostriction and domain arrangements leave much to be desired in simplicity and coherence of presentation and as a potential source for the liberal education of the novice in the fundamentals of domain theory.

The attempt to oversimplify the picture, which is so often necessary in this type of work, makes for a handful of lapses in rigor, such as the erroneous contention that cubic iron readily slips along planes as a means of explaining the symmetry observed in the early Bitter patterns. On the whole, this book can hardly be recommended as a primer in domain theory but will undoubtedly prove a fine reference to workers in the field as an exposition of an important and active phase of magnetic effects arising from domain phenomena which is, in fact, the avowed purpose of the monograph series of which this book is a part.

J. E. GOLDMAN

*Department of Physics,*
*Carnegie Institute of Technology*

***The Kinetic Basis of Molecular Biology.*** Frank H. Johnson, Henry Eyring, and Milton J. Polissar. Wiley, New York; Chapman & Hall, London, 1954. vii + 874 pp. Illus. $15.

Theories and techniques of modern physical chemistry are just beginning to assume an important place in the investigation of biological systems. This book is the most advanced and most useful presentation of the applications of physical chemistry to biology that has appeared. It is a valuable guide for all whose research approaches problems of living systems at the molecular level, particularly problems of a dynamic nature for the book emphasizes the application of classical and modern chemical-kinetics. It provides a source of prototype mechanisms, an extensive collection of reference material, and, most important of all, a solid introduction to the philosophy of present-day physical chemistry presented by men familiar with both the power of that subject and the complications encountered in biological systems.

The book breaks down into three parts. The first surveys rapidly, and probably inadequately for many natural scientists, the theories of modern physics and chemistry. Only Chapter 1, in which the theory of absolute reaction rates is derived, is essential for reading the remainder. The middle section is based on the well-known work of Johnson and Eyring and their collaborators on bioluminescence, but is extended to cover a wide variety of other problems more or less closely related to problems which have appeared in bioluminescence.

The third section examines permeation and diffusion phenomena in living systems, including extensive discussions of muscular contraction and nervous function. While there is less original material in this section, modern theories of the phenomena are presented on a more comprehensive and more satisfactory theoretical framework than has previously appeared. In particular, the discussions of active ion transport are the best thus far.

The book is uneven, somewhat special, and not comprehensive. Specialists reading discussions of subjects in their own fields will occasionally be dissatisfied, if not antagonistic, to detailed interpretations for little attempt has been made to examine alternative theories and frequently it seems that subjects have been "shoehorned" into a preconceived and inapplicable framework. Such objections are probably not particularly important. Although the authors have stated as their purpose the interpretation of a representative collection of biological phenomena, their major success lies not in this direction but in the procedures of thought and technique for the use of physical chemistry, implicit throughout the book. Especially important in this direction are the frequent uses of idealized systems that emphasize only the most essential molecules and characteristics of complicated systems, a technique exemplified in the authors' treatment of nerve processes. Undoubtedly many of the specific interpretations will not stand the test of time. The general methodology, on the other hand, is well tested and here to stay. The natural scientist will find this a useful handbook of application and a stimulating source of new ideas.

RUFUS LUMRY

*Department of Chemistry, University of Minnesota*

***Acoustics.*** Leo L. Beranek. McGraw-Hill, New York–London, 1954. x + 481 pp. Illus. $9.

Those who learned their acoustics from textbooks dated before about 1915 will gasp when they compare this up-to-date textbook with those of yesteryear. They will look in vain for the familiar chapters on the theory of vibrating strings, rods, bars, plates, and pipes, but they will find that acoustics has acquired a "new look" and many new sounds during these past four decades. Modern acoustics, in many respects, began in 1915 with the advent of electronics and the high-quality microphone. Beranek's book begins where the classical books ended. It is primarily a treatise of modern acoustics, a thoroughly teachable and practical book that can be commended to both professional and amateur acousticians. The acoustial engineer, and even many of those who retain him, will find ready solutions to many problems concerned with noise and electroacoustical devices.

Chapter 1 gives a brief introduction to modern acoustics and summarizes relevant American Standards acoustical definitions and terminology. Chapter 2 presents solutions of the wave equation in two parallel columns; the one-dimensional derivation in the first column and a juxtaposed three-dimensional vector derivation in the second column. Chapters 3–5 deal comprehensively with acoustical circuits, elements, radiation, and directivity patterns. Chapter 6 is a good compendium of available high-quality microphones, their characteristics and uses. Chapters 7–9 are a rich storehouse of descriptions, formulas, and design charts of the principal types of loudspeakers. High-fidelity fans will find this material helpful in selecting or constructing these crucially important parts of their high-fidelity radio receivers and phonographs, for example, page 212 gives directions for the design of a closed-box baffle for a high-quality loudspeaker, and page 242 gives practical design data for

a bass-reflex. (The directions are for those who wish to know *why* as well as *how*.) Chapter 10 deals with architectural acoustics, with emphasis on wave acoustics and sound insulation. Chapter 11, which deals with noise control, will be found extremely useful for the reduction of industrial noise. Chapter 12 is a good summary of acoustical measurements, especially those essential for noise surveys. The concluding chapter contains an up-to-date account of hearing, speech intelligibility, and pertinent psychoacoustic criterions. These criterions are as yet tentative but they will be welcome and useful to the acoustical engineer and to all those who are concerned with noise control.

The mks system of units is used throughout the book. Although many physicists and engineers may believe that this choice is not justified in view of the widespread use of cgs units, it is apparent, especially in Chapters 3 and 10, that simplicity results from the choice of the mks system. But for one who has been steeped for two score years and more in cgs units, the mks ones are distasteful pills for a mild disease. Beranek has sugar-coated most of these pills by adding in parentheses the more familiar cgs units.

The drawings and illustrations are well chosen and executed and supplement the text admirably. Throughout the book typical examples involving practical design are worked out in detail, and these are often followed by other useful examples and problems that the student is expected to solve. Acoustical engineers, as well as students and others interested in acoustics, will be greatly indebted to Beranek for this useful and well-written book.

VERN O. KNUDSEN

*Department of Physics,*
*University of California, Los Angeles*

***Chemical Constitution.*** An introduction to the theory of the chemical bond. J. A. A. Ketelaar. Trans. by L. C. Jackson. Elsevier, Houston, Engl. ed. 1, 1953. 398 pp. Illus. $6.50.

The purpose of this book, according to the author, is to so complement the standard textbooks of organic and inorganic chemistry that it will enable students to convert the large volume of chemical information into a single, coherent body. In this he has completely succeeded and thus has contributed a significant advance to the integration of chemistry on a graduate level.

The first chapter serves to set forth the four types of chemical affinity (ionic, atomic, metallic, and Van der Waals) upon which the division of subject matter is based. In the next chapter the concept of the ionic bond, developed on the basis of electrostatic attractive forces between charged spheres, is applied to ionic complexes as well as to simple salts. The third and longest chapter is a wave-mechanical development of the covalent bond, with many examples and applications to complex compounds, conjugation, and the theory of color. The interatomic attractive forces and various properties of metals are developed in the following chapter with the analogy of the electron in a box and the concept of Brillouin Zones. In the fifth and last chapter Van der Waals binding, explained as a combination of Keesom orientation energy, Debye inductive effects, and London dispersion forces, is applied to volatility, solubility, and hydrogen bonding.

This book has many excellent examples and correlations of theory and fact. Many of the relationships described, particularly in connection with ionic and metallic binding, are too frequently omitted from textbooks in this country. The author points out the importance of Coulomb forces, rather than electron pairing, as the source of exchange energy, and emphasizes this point by substituting a newly coined term, *atomic bond*, for the more familiar *covalent bond*.

It is unfortunate that such a useful book is marred by many errors. The English expression is so awkward that the meaning is sometimes obscured. In some cases lack of clarity is due to the omission of details and explanations required in the coverage of such a broad subject in a relatively small number of pages. Many authors are referred to without specific literature references. One might disagree with the classification of the hydrogen bond as a Van der Waals, rather than an ionic, type of bond. One might also wish that more space had been devoted to molecular refraction and polarizability, acids and bases, electrophyllic and nucleophyllic properties, and the role of *d*-orbitals in the formation of coordination compounds.

The main usefulness of this book lies in its value as a survey and integration of chemical theory and fact. In my opinion, it cannot be used by students without previous courses in organic, inorganic, and quantum chemistry, unless extensive simultaneous use is made of standard references in these fields.

ARTHUR E. MARTELL

*Department of Chemistry, Clark University*

***The Kidney.*** A Ciba Foundation Symposium arranged jointly with the Renal Association. A. A. G. Lewis and G. E. W. Wolstenholme, Eds. Little, Brown, Boston, 1954. xvi + 333 pp. Illus. + plates. $6.

This is a verbatim account of the proceedings of an international symposium held in London in July 1953. Not since 1935, when the Minneapolis symposium of a lustrum earlier became *The Kidney in Health and Disease*, has any volume appeared of substance and merit comparable to Ciba's *The Kidney*. Interestingly, there was no individual who contributed to both of these symposiums.

Twenty papers are allocated in five parts: I, "Structural and functional relationships in the kidney" (Oliver, Raaschou, Darmady, Wirz); II, "Tubular functions other than the regulation of acid-base balance" (Bradley, Taggart, Lambert, Reubi); III, "Renal share in the regulation of acid-base balance" (Robinson, Pitts, Berliner, Sanderson); IV, "General problems of electrolyte excretion" (Merrill, Le

Quesne, Milne, Alwall, Dent); V, "Renal share in volume control of body fluid" (Borst, Hamburger, Black).

Almost every paper is a valuable summary of an active area of modern renal physiology, pathology, or morphology. While much of the material stands in the literature, it is served here in a series of thumbnail sketches that are commendable for brevity, lucidity, and documentation. In format, each presentation is followed by a typographically distinct section containing the discussion.

The general excellence of the whole makes it invidious to draw attention to selected, unfavorable aspects. It is with no intent, therefore, to plant a seed of disaffection that we dispute the treatment accorded to renal volume control. The renaissance of interest in the kidney as a regulator of body fluid volumes is reflected in its coverage, at least nominally, to the extent of 20 percent of the symposium. However, the fundamental biology of volume regulation such as outlined by Henderson and others is nowhere acknowledged, much less clarified; and no one comes to grips with this slippery problem. The papers and discussions are agreeable enough in summarizing facts but do not go far toward an understanding of the subject. It might have been more enlightening if, for example, Heller's censure of the term *volume receptor*, instead of being allowed to evaporate, had been examined critically in discussion.

*The Kidney* is an attractive book, printed on good paper, carefully edited, properly indexed, and fairly priced.

A. V. Wolf

*Army Medical Service Graduate School*

***The Moon Puzzle.*** A revived classical theory correlating the origin of the moon with many problems in natural science. N. O. Bergquist. Grafisk Forlag, Copenhagen, 1954. xiii + 378 pp.

The author gives a comprehensive survey of what he considers to be the consequences of the following theory. The origin of the moon was caused by a cosmic collision; the birth of the moon occurred at the end of Lower Cretaceous time and caused the great break in continuity at this time observed by both geologists and paleontologists.

The story unfolded by Bergquist is fascinating but often gives the impression of science fiction rather than of science. There is a practically complete lack of quantitative mathematical argument (frankly admitted by the author). And the multitude of effects that he attempts to explain leads one to think of the quotation "Methinks he doth protest too much."

A few detailed criticisms—which are invited by the author explicitly—may follow here. Page 39: It is nowadays generally believed that the development of spiral nebulae is one toward and not away from orderliness (see, for example, von Weizsacker, *Z. Astrop.* 1948). Page 69: East Indies is an obsolete term and the correct term is Indonesia. Page 366: If the moon originated in the way proposed by the author, the calculations of Jeffreys (*The Earth*), of the moon's age, are relevant and they lead to an age of at least 2000 million years in contradiction to the age inherent in the proposed theory.

D. ter Haar

*Department of Natural Philosophy, St. Andrews University*

***An International Bibliography on Atomic Energy.*** vol. 2: *Scientific Aspects.* Suppl. No. 2. United Nations, New York, 1953 (U.S. Distr.: Columbia Univ. Press, New York). vii + 320 pp. $3.50.

This is a classified listing of 7997 periodical articles that appeared during 1951–52 on fundamental nuclear science, physics and engineering of nuclear energy, biological and medical effects of high-energy radiation, isotopes in biology and medicine, and applications of nuclear physics in nonbiological sciences and technology. An author index is appended.

***Gmelins Handbuch der Anorganischen Chemie: Selen*** (Selenium), System No. 10, pt. A, sec. 3, 1953. xviii + 184 pp. Illus. Paper, $26.64.

***Gmelins Handbuch der Anorganischen Chemie: Bor*** (Boron), System No. 13, supp. vol., 1954. vii + 253 pp. Illus. Paper, $33.60; cloth, $34.80.

***Gmelins Handbuch der Anorganischen Chemie: Gold,*** System No. 62, pt. 2, 1954. v + 306 pp. Illus. Paper, $40.32

***Gmelins Handbuch der Anorganischen Chemie: Gold,*** System No. 62, pt. 3, 1954. xxi + 558 pp. Illus. Paper, $74.88. Edited by Gmelin Institute. Verlag Chemie, Weinheim, W. Germany, ed. 8. (U.S. Distrib.: Walter J. Johnson, New York, and Stechert-Hafner, New York.)

In rapid succession the various sections of Gmelin have been making their appearance, bringing up to date this classic handbook of inorganic chemistry. The sections here considered total approximately 1300 pages and reflect credit on those responsible for these revisions.

Section A3 on selenium is devoted to the selenium rectifier and the selenium photocell, subjects that have increased in interest in the past 15 years. The literature in this section is covered to 1953.

The present volume on boron is the first complete and modern monograph of this element and its compounds. It is a supplementary volume to that on boron published in Gmelin's handbook in 1926 and covers the literature for the years 1925–1950. Its subject index contains references to both these volumes. A feature of the new volume is the inclusion of the advances that have been made on borane and its related compounds, such as the borazoles, borazens, borazanes and their alkyl derivatives, alkyl boron compounds, alkyl boric acids, the boroxoles, boric acid

esters, and alkyl boron halides. Likewise included are boron fluoride with its many addition compounds, fluoroboric acids, crystalline boron, boron oxide, metaboric acid, boron carbide, and borides.

Section 2 on gold covers the main subjects of occurrence, technical extraction, preparation of special forms of gold in the pure state, concentration and separation of gold isotopes, colloidal gold, and the surface treatment of gold and gold alloys.

Section 3 on gold completes the series on this metal. It covers the physical properties of gold, its electrochemical, chemical, and physiological behavior, its detection and determination, the general reactions of gold compounds, and alloys of gold. This last chapter emphasizes the copper-gold and the copper-silver-gold alloys, since they are the ones pertinent to the goldsmith's trade and to dentistry.

RALEIGH GILCHRIST

*Division of Chemistry, National Bureau of Standards*

***List of Land Mammals of New Guinea, Celebes, and Adjacent Islands, 1758–1952.*** Eleanor M. O. Laurie and J. E. Hill. British Museum (Natural History), London, 1954. 175 pp. + 3 plates. £1 10s.

Our knowledge of the land mammals of New Guinea, Celebes, and many of the adjacent islands has reached a stage where a check list of the known forms has been urgently indicated. Such a list together with a considerable amount of generic revision has now been provided in this work.

As reference material for their revisionary work the authors have had the use of the very fine study collections in the British Museum. Much additional material in foreign museums and the incomparable Archbold collections of nearly 20,000 specimens at the American Museum could not be reviewed first hand. The opinions of the revisers of these collections, however, have been carefully evaluated by the authors in reaching their own decisions. Much additional fieldwork will be necessary before the systematic picture becomes reasonably stabilized in this "frontier" region. The present list with its meticulously compiled bibliographic detail checked against the original sources and its view of establishing groups with biological reality will be of untold value to future revisers.

Some of the details of solid reference value that should be noted in this work are: complete listing of valid names and synonyms; ranges, when known, concisely drawn; bibliographic notations (for example, last revisers of certain genera) generously provided throughout; when the authors follow the classification of other writers, it is so stated and the reference given; subspecies arranged in the chronological order of their names; a gazetteer of all type localities and of the more obscure collecting stations; an excellent index.

The authors recognize 351 species. They have described a number of new species and subspecies, but most noteworthy is the description of a new Hydromyine genus, *Mayermys*. The molar teeth of this peculiar little rodent are minute and are reduced to one in each of the upper and lower jaws, a condition now reported for the first time and adequately illustrated by three plates. The omission from the list of the genus *Xenuromys*, described by Tate and Archbold in 1941 is an oversight.

Laurie and Hill should be complimented on their addition to the British Museum's growing file of regional check lists of the mammals of the world. The printing job is excellent.

HOBART M. VAN DEUSEN

*American Museum of Natural History, New York*

***Proceedings of the Second National Cancer Conference, 1952.*** vols. I and II. American Cancer Society, New York, 1954. 1687 pp. + index. Illus. Set of two volumes, $7.50.

Of nine papers in general sessions, seven dealt with problems of interest to the practicing physician.

According to Overholt, lung cancer should be the most readily discovered form of internal malignancies. In Pendergrass' opinion, early detection of lung cancer requires at least two chest films and interpretation by two competent radiologists. Pack reviewed the puzzles of melanoma and Papanicolaou lectured on cytodiagnosis. Wangensteen started his paper asserting that "no one knows very much about cancer," and later maintained that the *only* hope lies in early diagnosis and most radical surgery, the results of which it is still "too early" to appraise.

The philosophy of early diagnosis was courageously challenged by Lees and McKinnon, and defended by others. No decisive proof was provided by either side. The discussion of therapeutic progress encompassed matters of classifying carcinoma *in situ*, of borderline and doubtful cases, of precancerous conditions, of improved technique, as well as the often reviewed problems of clinical versus histological criterions, of simple versus radical mastectomy, of surgery versus roentgentherapy, supervoltage radiation, and hormonal therapy and castration. Following bilateral adrenalectomy Bergenstal and Huggins observed temporary tumor regression in some of their 35 patients with only two operative deaths.

One-half of the panels were devoted to histology, diagnosis, clinical features and therapeutic achievements including isotopes, chemistry and caloric restriction in cancer of the head and neck, breast, genitourinary organs, gastrointestinal organs, lung and in lymphoma and leukemia. In other panels were considered virology including "vertical" transmission in mice (Bittner, Gross), chemo-cancerogenesis, radiobiology, steroids and genetics. Several papers dealt with familial occurrence of cancer (Macklin, Busk, Wintrobe, Murphy, Oliver).

Relatively little space was given to epidemiology. Statistical papers were read by Dorn, Symeonidis, and Stewart. Surveying epidemiology of lung cancer,

Graham did not even mention Joachimsthal and the Walesian nickel-refineries. Hueper excellently reviewed occupational bladder cancer. According to Gagnon, cervix cancer is extremely rare in nuns—only 0–3 percent of all uterine plus ovarian malignancies. This ratio for virgins complements the following series of values for single nulligravidae (regardless of virginity), for married nulligravidae, unigravidae, women with 2–10 and with 11–20 pregnancies: 48.3, 58.6, 76.8, 83.8 and 92 percent, respectively (the reviewer, 1923). Gagnon and Nieburgs doubt the existence of a relationship between pregnancies and cervix cancer.

In his closing remarks, Cameron rightfully referred to the broad spectrum of problems of the conference.

SIGISMUND PELLER
*164 East 81st St., New York, N. Y.*

***New Research Techniques in Physics.*** Symposium (UNESCO) sponsored by the International Union of Pure and Applied Physics (chapters in English, Spanish, and Portuguese). Academia Brasileira de Ciencias, Rio de Janeiro, Brazil, 1954. 447 pp. Illus.

Published reports on the proceedings of international conferences are valuable, not only to the participants but also to interested scientists who were unable to attend the conference, especially if the various discussions following formal papers are included and if publication is prompt. The proceedings of the symposium held in July 1952 at Rio de Janeiro and at São Paulo have now been issued in the form of a book entitled *New Research Techniques in Physics.* In it are included 65 papers, varying in length from one to 26 pages, on a large variety of subjects, together with the discussions that followed several of the presentations. Although the 2-year delay in publication reduces the interest in some of the work, the lively spirit of the conference is well preserved.

The new research techniques discussed include procedures and methods in both experimental and theoretical physics, classical and modern. There are numerous articles on high energy accelerators, including those at Illinois, Chicago, Wisconsin, São Paulo, and Mexico City. In some articles the techniques are emphasized; others are presentations of results of observations. The techniques related to construction of Geiger counters, ionization chambers, Cerenkov counters, diffusion cloud chambers, and even ionization gages are described. Several papers are devoted to cosmic ray studies, including geomagnetic effects and transition phenomena in the atmosphere and in solid materials.

It is somewhat difficult for me to separate papers on the techniques of theoretical physics from those on the results of theoretical calculations. Several distinguished theorists were present and the subjects ranged from the fundamentals of quantum theory and field theory through meson theory and nuclear forces and fundamental particles to the dynamic theory of scattering.

The papers are quite uneven in quality and importance, but almost every physicist will find something to interest him in this book, if only because of the breadth of the subject matter.

W. B. FRETTER
*Department of Physics,*
*University of California, Berkeley*

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# *Books Reviewed in* THE SCIENTIFIC MONTHLY

## January

***Snow Crystals: Natural and Artificial,*** Ukichiro Nakaya (Harvard Univ. Press). Reviewed by K. L. S. Gunn.

***The Western End of Lake Erie and Its Ecology,*** T. H. Langlois (J. W. Edwards). Reviewed by J. E. Bardach.

***A Brief Text in Astronomy,*** W. T. Skilling and R. S. Richardson (Holt). Reviewed by W. F. Shenton.

***The Neolithic Cultures of the British Isles,*** Stuart Piggott (Cambridge Univ. Press). Reviewed by R. W. Ehrich.

***V-2,*** Walter Dornberger (Viking). Reviewed by T. S. Gardner.

***Ways of the Ant,*** John Crompton (Houghton Mifflin). Reviewed by G. C. Wheeler.

***Math Is Fun,*** Joseph Degrazia (Emerson). Reviewed by S. B. Myers.

***Main Currents of Scientific Thought,*** S. F. Mason (Abelard-Schuman). Reviewed by R. J. Seeger.

***World Geography: An Introduction,*** Loyal Durand, Jr. (Holt). Reviewed by W. A. Hance.

***Theory and Method in the Social Sciences,*** Arnold M. Rose (Univ. of Minnesota Press). Reviewed by Conrad Taeuber.

***Sea-Birds,*** James Fisher and R. M. Lockley (Houghton Mifflin). Reviewed by C. H. Rogers.

***The Meaning of Social Medicine,*** Iago Galdston (Harvard Univ. Press). Reviewed by A. D. Bass.

***How Strong Is Russia?*** G. B. Cressey (Syracuse Univ. Press). Reviewed by M. F. Burrill.

***The Flood Control Controversy,*** L. B. Leopold and Thomas Maddock, Jr. (Ronald Press). Reviewed by W. H. Rowan.

***A Thousand Geese,*** Peter Scott and James Fisher (Houghton Mifflin). Reviewed by H. I. Fisher.

***Urban Behavior,*** E. G. Ericksen (Macmillan). Reviewed by H. J. Graalfs.

***Man, Time, and Fossils,*** Ruth Moore (Knopf). Reviewed by Bentley Glass.

***The Mating Instinct,*** L. J. and M. J. Milne (Little, Brown). Reviewed by L. R. Aronson.

***So Little for the Mind,*** Hilda Neatby (Clarke, Irwin). Reviewed by Eugene Forsey.

***Educational Psychology,*** L. J. Cronbach (Harcourt, Brace). Reviewed by R. W. Husband.

***Applied Atomic Energy,*** K. Fearnside, E. W. Jones, and E. N. Shaw (Philosophical Library). Reviewed by R. A. Charpie.

***Fifty Years of Medicine,*** Lord Horder (Philosophical Library). Reviewed by M. C. Leikind.

***Engineers' Dreams,*** Willy Ley (Viking). Reviewed by T. S. Gardner.

# Technical Papers

## Some Potassium-Argon Ages for Ontario

H. A. Shillibeer and K. Watson
*Department of Physics, University of Toronto, Canada*

Potassium contains the naturally radioactive isotope $K^{40}$, which decays by beta emission to calcium-40 and by orbital electron capture to argon-40. To measure the age of a potassium mineral, it is necessary to extract and measure either the radiogenic calcium-40 or the radiogenic argon-40 contained in the mineral. In addition a potash analysis must be made. All results (*1*) reported here were made by extracting the argon from a mineral, measuring the volume by means of a McLeod gage, and determining the radiogenic purity of the argon by a mass spectrometer.

Because of the dual decay process, it is necessary to stipulate two decay constants in order to describe the decay scheme of potassium-40 completely. The decay constants that we have used in all calculations are

$$\text{Decay constant for beta emission} = \lambda_\beta = 0.503 \times 10^{-9}\ \text{yr}^{-1},$$

$$\frac{\text{Decay constant for orbital electron capture}}{\text{Decay constant for beta emission}} = R = 0.089,$$

where $R$ is the branching ratio. The decay constant for beta emission is the mean of 11 of the most recent counting experiments (*2*). The branching ratio used was determined by using results obtained by two different laboratories on potassium feldspars of known age (*3*). Using these decay constants, we have obtained many potassium-argon ages that are in agreement with lead-uranium and lead-lead ages from the same localities (*2*). The experimental procedure has been reported at length in a previous paper (*2*).

The formula used in calculating potassium-argon ages is

$$\frac{A^{40}}{K^{40}} = \frac{R}{(1+R)}\{e^{(\lambda+R)\lambda_\beta t} - 1\},$$

where $A^{40}$ is the mass of radiogenic argon-40 present per gram of mineral sample, $K^{40}$ is the mass of potassium-40 per gram of mineral sample, and $t$ is the age of the mineral. With our decay constants and transposing, this becomes:

$$t = \frac{10^9}{0.548} \ln \left\{1 + 12.18 \frac{A^{40}}{K^{40}}\right\} \times 10^9 \text{ yr.}$$

The results given in Table 1 are for a number of potassium minerals from Ontario, Canada.

Most of the potash determinations were made with a flame photometer at Toronto by K. Watson. The standard deviation of three individual determinations on each sample is given. The error in the ages is calculated for a possible 10-percent error in the $A^{40}/K^{40}$ ratio.

The tests on associated minerals from the same pegmatite were made to determine whether consistent results would be obtained for minerals of entirely different lattice structure. It is obvious that each pair of associated minerals gives results that agree within the experimental error. Two separate samples of feldspar from MacDonald mine, Monteagle Township, were run. The first sample, 1019-A, had been ground to 200 mesh (0.01 cm) 2 yr prior to the runs, and the

Table 1. Potassium-argon ages for some Ontario samples.

| Toronto No. | Location* | Mineral | Longitude, latitude | % by wt. radiogenic $A^{40}$† | No. of runs | % by wt. $K_2O$ | $A^{40}/K^{40}$ | Age‡ |
|---|---|---|---|---|---|---|---|---|
| 1107-A | Dill Twp. | Perthite | 80°50′W 46°24′N | $6.57 \pm 0.32 \times 10^{-6}$ | 8 | 12.56 | 0.052 | $900 \pm 70$ |
| 1109-A | Dill Twp. | Mica | ..... | $5.11 \pm 0.47 \times 10^{-6}$ | 3 | $9.66 \pm 0.18$ | .052 | $900 \pm 70$ |
| 1223-A | Conger Twp. Lot 7, Con. X | Perthite | 79°51′W 45°15′N | $7.26 \pm 0.14 \times 10^{-6}$ | 2 | 13.0(5) ± .05 | .055 | $930 \pm 70$ |
| 1224-A | Conger Twp. Lot 7, Con. X | Mica | ..... | $5.55 \pm 0.41 \times 10^{-6}$ | 2 | $8.76 \pm 0.26$ | .062 | $1030 \pm 80$ |
| 1019-A | MacDonald mine, Monteagle Twp. Lot 19, Con. VII | Perthite | 77°48′W 45°10′N | $6.20 \pm 0.10 \times 10^{-6}$ | 2 | 11.9(7) ± 0.12 | .051 | $890 \pm 70$ |
| 1028-A | Second sample | Perthite | ..... | $6.29 \pm 0.10 \times 10^{-6}$ | 2 | 11.8 ± 0.24 | .053 | $910 \pm 70$ |
| 1178-A | Besner mine, Henvey Twp. Lot 5, Con. B | Perthite | 80°31′W 45°48′N | $6.87 \pm 0.16 \times 10^{-6}$ | 2 | 13.2 ± 0.2 | .052 | $900 \pm 70$ |

* Samples 1223-A, 1224-A, 1019-A, 1028-A, and 1178-A were collected by R. D. Russell and R. M. Farquhar. Samples 1107-A and 1109-A were collected by H. A. Shillibeer.
† Uncertainty shown is standard deviation of individual measurements.
‡ Limits of uncertainty based on estimated mean probable error of ± 10 percent in $A^{40}/K^{40}$ ratio.

second sample, 1028-A, was freshly ground. The results agree within our experimental error.

An associated uraninite found with the Besner mine feldspar gave a lead-lead age of $(940 \pm 50) \times 10^6$ yr in agreement with our potassium-argon age (*4*). A. O. Nier has published lead-lead and lead-uranium ages for a uraninite from Blackstone Lake, which is approximately ½ mi from the location of our Conger Township samples (*5, 6*). The mean age of this uraninite is $1010 \times 10^6$ yr in good agreement with our potassium-argon ages. Similar results have been obtained by Wasserburg and Hayden (*7*).

These results provide additional support for potassium-argon ages and indicate that the age limits of 800 to 1100 million years assigned to the Grenville orogeny are reasonable (*8*).


### References and Notes

1. This investigation was assisted by grants from the National Research Council of Canada and the Geological Survey of Canada.
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17 September 1954.

## Critique of Extracellular Space Measurements with Small Ions; $Na^{24}$ and $Br^{82}$ Spaces


**Solomon A. Berson and Rosalyn S. Yalow**

*Radioisotope Service, Veterans Administration Hospital, Bronx, New York*


Perhaps the most generally accepted reference substances for the measurement of extracellular fluid volume are inulin (*1*) and sucrose (*2*), which are thought to be incapable of entering cells, at least in normal circumstances. Since prolonged periods for complete equilibration in extracellular fluid are required, owing to the relatively large molecular size and slow diffusion rates of these substances in tissue, the search continues for other agents that might permit more rapid equilibration and simpler experimental procedure. Both sodium and bromide are known to penetrate cells to a certain extent, and the space of distribution of $Na^{24}$ 3 hr following intravenous administration (*3*) is significantly in excess of that now believed to represent the volume of the extracellular compartment. However, it was thought that intracellular permeation might be sufficiently slow compared with extracellular diffusion to permit evaluation of the extracellular compartment.

The concentration-time course of radioactivity in plasma, following intravenous administration of $Na^{24}$ or $Br^{82}$ to human subjects, is a multicomponent curve. The concentration in terms of the fraction of the total radioactivity in the body per liter of plasma (Fig. 1*A*) becomes virtually constant after about 12 hr in

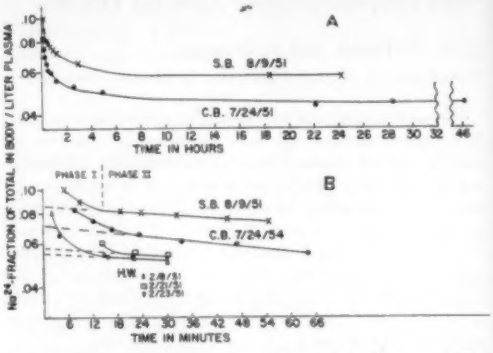


Fig. 1. Venous plasma curves. Phase I is related chiefly to mixing in extracellular fluids.

normal subjects. Between about 15 to 20 min and 1 hr (phase II), the concentration decreases almost exponentially (Fig. 1*B*) with a much shallower slope than during the initial period (phase I). It seemed reasonable to suppose that phase I may reflect, primarily, mixing in extracellular fluid and that phase II is chiefly attributable to penetration of cells and (in the case of $Na^{24}$) bone apatite. Then the extracellular fluid volume would be given approximately by the reciprocal of the zero time extrapolation of phase II, assuming that intracellular penetration proceeded at the same rate throughout phase I as during phase II.

This assumption introduces at least slight errors into the calculations, since these ions cannot penetrate most tissue cells until they have diffused through some part of the extracellular compartment. In addition, errors of unknown magnitude may result from very rapid penetration of some cells during the period of extracellular diffusion. Entrance of $Na^{24}$ into erythrocytes is negligible at this time, but equilibration of $Br^{82}$ between erythrocytes and plasma occurs almost instantaneously and can be corrected for by simultaneous measurement of total red cell volume. Negligible amounts (½ percent or less) of either ion are excreted during the first ½ hr.

The calculations just described have yielded values for extracellular space in nonedematous subjects which are reproducible (H.W., Fig. 1*B*) and are in good agreement with those obtained by inulin or sucrose—that is, about 13 to 19 percent of body weight (Table 1). It was further observed that simultaneous space measurements with $Na^{24}$ and $Br^{82}$ (Fig. 2) give almost identical values when correction is made for $Br^{82}$ in erythrocytes (Table 2). However, certain observations demonstrate the unreliability of these estimates of extracellular fluid in patients with large extracellular fluid collections such as edema, ascites, and pleural effusion. The specific activities in the abnormal fluid

Table 1. Extrapolated early $Na^{24}$ spaces in nonedematous subjects.

| Subject | Diagnosis | 'Extracellular' space* (% body wt.) |
|---|---|---|
| S.B. | Diabetes | 17.3 |
| F.B | Rheumatoid afthritis | 13.9 |
| H.W. | Compensated cirrhosis | 16.7 |
| B.G. | No disease | 16.5 |
| A.C. | Polycythemia | 17.4 |
| S.B. | No disease | 13.8 |
| C.B. | Uretero-sigmoidostomy | 18.2 |

* Corrected for plasma water and the Gibbs-Donnan factor.

Table 2. Extrapolated early $Na^{24}$ and $Br^{82}$ spaces* (percentage of body weight).

| Subject† | $Na^{24}$ | $Br^{82}$ | $Na^{24}/Br^{82}$ |
|---|---|---|---|
| S.K. | 19.4 | 20.1 | 0.965 |
| D.L. | 26.2 | 27.0 | .972 |
| D.D. | 18.5 | 18.1 | 1.02 |
| K.A. | 21.1 | 21.1 | 1.00 |

* Corrected for plasma water and the Gibbs-Donnan factors. $Br^{82}$ spaces have also been corrected for red cell penetration.
† Nonedematous subjects with malignancies. High values for the spaces relative to body weight are related to marked weight loss.

collections may not reach that of the plasma for several hours (Fig. 3), indicating that equilibration in these extracellular fluid spaces is far from complete at the time of onset of phase II. Kaltreider and associates (*3*) noted that pleural fluid equilibration may not be complete in some cases even after 3 to 6 hr. Thus the value derived from extrapolation of the slow component seriously underestimates the true extracellular space in these cases. Although it is virtually impossible to obtain satisfactory samples of extracellular fluid in nonedematous subjects, the concentration curve of thoracic duct lymph (Fig. 3) indicates that, in some extracellular sites at least, equilibration is not complete by the time of onset of phase II. This is almost certainly also true of tendon and similar tissues, in which extracellular diffusion equilibrium is prolonged (*4*).

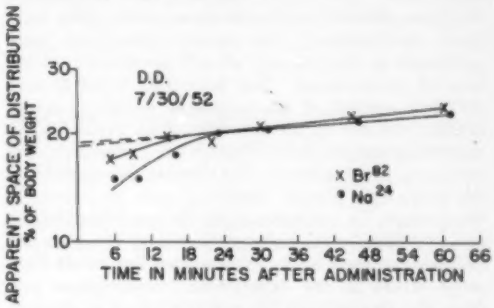


Fig. 2. Spaces of distribution of $Na^{24}$ and $Br^{82}$. Spaces were calculated from the venous plasma concentrations, correcting for erythrocyte penetration of $Br^{82}$ and for plasma water and Gibbs-Donnan factors.

It appears likely that in nonedematous subjects all small freely diffusible ions distribute into a large fraction of the extracellular compartment within 15 to 20 min or so. However, extracellular space is not completely equilibrated at this time, and some intracellular sites have probably also been penetrated. Although the apparent space of distribution may then fairly well approximate the true extracellular space,

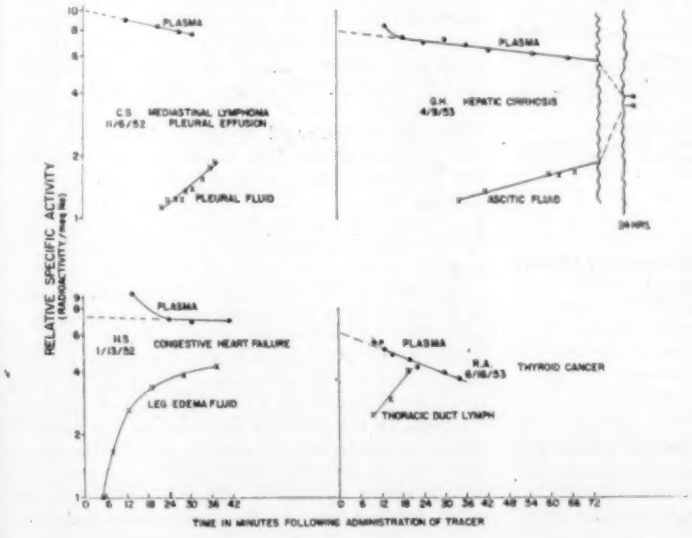


Fig. 3 Relative specific activities of venous plasma and extracellular fluids as a function of time following intravenous administration of $Na^{24}$.

this value is clearly not to be relied upon as a precise measure of extracellular fluid. Where the extracellular fluid is markedly increased, such measurements are grossly in error.

Thiosulfate (*5, 6*) and radiosulfate (*7, 8*) have been suggested as useful for the measurement of extracellular space. However, the criticisms that have been directed against $Na^{24}$ and $Br^{82}$ apply with the same force to any other ions that penetrate cells or undergo metabolism. The studies reported with radiosulfate and thiosulfate have failed to demonstrate either complete equilibration in the various extracellular compartments or the absence of cell penetration at the time of measurement. They have also failed to take sufficient account of the prolonged period of equilibration required in the presence of an expanded extracellular compartment. Thiosulfate, particularly, has additional disadvantages. The exponential segment of the thiosulfate plasma curve has such an extremely sharp slope, in consequence of its rapid metabolism and excretion by the kidneys, that large errors in the ordinate intercept of the extrapolated line result from small errors in the experimental observations and from the invalidity of the assumption of a constant rate of intracellular penetration. Furthermore, it appears from the published figures (*5*) that the exponential segment of the plasma curve (phase II) may begin as early as 2 min after the end of an 8-min infusion of thiosulfate. Since thiosulfate has a smaller diffusion coefficient than $Na^{24}$ and $Br^{82}$, it is difficult to accept complete extracellular equilibration of thiosulfate in this short time, and it may be concluded that measurements with this ion are even less reliable than those utilizing $Na^{24}$ and $Br^{82}$, which are at least free from the objections of rapid metabolism and excretion.

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23 September 1954.

## Melanophore-Contracting Hormone (MCH) of Possible Hypothalamic Origin in the Catfish, *Parasilurus*


Masashi Enami

***Endocrinological Laboratories, Gunma University, Maebashi, Japan***


Although it is well established that the pituitary is the source of a melanophore-expanding hormone (intermedin), there is no conclusive evidence for the existence of another kind of pigmentary hormone antagonistic to intermedin (W-substance of Hogben). There are only indirect indications, such as the observation that pigment concentration in the melanophores is disturbed in the absence of the pars tuberalis in amphibians or of the pars distalis in elasmobranchs. The effect of injection of extracts or of implantation of possible sources of the presumed melanophore-contracting hormone has as yet not been adequately studied (*1*).

In the present investigation it was found that crude aqueous extracts prepared from the hypothalamus and from the pituitary of the oriental catfish, *Parasilurus asotus*, contain, in addition to intermedin, a hormone principle responsible for melanophore contraction. This principle is tentatively designated as

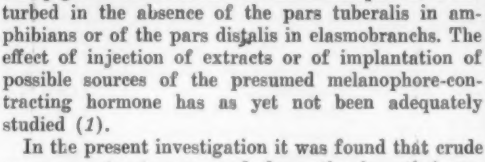

Fig. 1. Catfishes showing the effect of injection of hypothalamic extracts: (top) local effect of crude aqueous extracts; (bottom) pronounced effect of concentrated alcohol-insoluble fraction.

MCH (melanophore-contracting hormone). The extracts mentioned, when injected into "black adapted" hypophysectomized catfish with approximately intermediate pigment dispersion (*2*), caused a marked but localized pallor at the site of injection and simultaneously a considerable darkening of the rest of the body. Highly concentrated extracts resulted in increased blanching, but generalized pallor was rarely observed following the injection (Fig. 1). Administration of fractions obtained by treatment of the extracts with absolute ethanol showed that the alcohol-insoluble fraction had a higher MCH content, being comparatively free of the antagonistic intermedin which was concentrated in the alcohol-soluble fraction. In pieces of skin kept *in vitro*, the melanophores that had been made to expand under bright light responded well to the MCH fraction of the extracts. As a result of dilution experiments, a measure for MCH activity was determined in such a way that the potency of an extract which was sufficient to induce a state of maximal melanophore contraction *in vitro* in 15 min at 20°C was designated as one *Parasilurus* unit (PU). A comparison of the relative effect, in terms of PU, of hypothalamus and pituitary extracts showed that the concentration of MCH in the pituitary was approximately 4 or 5 times that of the hypothalamus. In the pituitary, the hormone was found in highest concentration in what is called "Übergangsteil" (*3*), namely, the characteristic component of certain teleost pituitaries situated between the so-called anterior lobe and the neuro-intermediate lobe.

In the hypothalamus, MCH was found most concentrated in the median portion of the posterior half, including the part overlying the anterior lobe of the pituitary.

At first, these findings seemed to suggest that the presence of MCH in the hypothalamus might be the result of a possible diffusion into the hypothalamic tissue of hormone originating in the "Übergangsteil" of the pituitary. Similar interpretations have been suggested in other cases, as for instance with respect to the distribution of intermedin (*4*). However, the results of this investigation do not support such an assumption. It was found that the hypothalamic extracts did not suffer a significant loss of MCH after total hypophysectomy. Furthermore, following surgical lesions of the median eminence, the MCH content of the pituitary decreased gradually in the course of the postoperative period. Also, the transection of the pituitary stalk resulted in appreciable decrease of the hormone contained in the "Übergangsteil" of the pituitary. These data could best be explained in the light of the current concept of neurosecretion (*5*): MCH could be produced by neurosecretory elements in the hypothalamus and transported via the pituitary stalk to the "Übergangsteil" for storage. On histologic examination, the portion of the hypothalamus that yields the most potent MCH extract includes groups of neurosecretory cells identified as the nucleus lateralis tuberis. The possibility of MCH production in this neurosecretory hypothalamic nucleus is being studied.

As reported earlier (*6*), *Parasilurus* is unique in that its melanophores do not respond to adrenalin by contraction; noradrenalin is equally ineffective. Acetylcholine was found to be a potent melanophore-contracting agent, being effective at concentrations as low as 0.001 μg/ml in the *in vitro* test. Accordingly, from the qualitative point of view, MCH resembles acetylcholine, but considerable differences exist between the two substances. In contrast to the prompt activation of the melanophores by acetylcholine, which is completed in less than 1 min, the effect of MCH develops much more slowly, attaining its maximum after more than 10 min in the *in vitro* assay. It is of interest that the effect of MCH was not blocked by atropine as demonstrated by experiments carried out both *in vivo* and *in vitro*. Whether such differences are due to chemical differences between MCH and acetylcholine, or whether the characteristic activity of MCH can be attributed to bound acetylcholine, is an open question. It may be added that MCH activity was not detected in extracts of the hypothalamus and of the pituitary of the dog, the rat, and the frog, *Rana nigromaculata nigromaculata*. This agrees with the hypothesis that the nucleus lateralis tuberis is the source of MCH, since this nucleus is absent in frog, rat, and dog.

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27 September 1954.

## Biochemistry of Amphibian Metamorphosis: I. Enhancement of Induced Metamorphosis by Gluco-corticoids


Earl Frieden and Barbara Naile

*Department of Chemistry, Florida State University, Tallahassee*


A relationship between thyroid-induced metamorphosis and gluco-corticoid action is not unexpected, since both of these hormones have an important role in protein mobilization (*1*). Yet the evidence on this point is unclear. Woitkewitsch (*2*) observed no acceleration of metamorphosis upon implantation of mammalian adrenal cortex in tadpoles. Boek (*3*) reported an increase in metamorphic rate of thyroxin-treated tadpoles after cortin administration. Sluczewski and Roth did not record any cortisone stimulation but found that ACTH stimulated normal and induced metamorphosis of the axolotl (*4*). Kuusisto and Telkka (*5*) noted no effect of cortisone on the metamorphosis of *Rana temporaria*.

In a survey of chemical factors that influence metamorphosis, we have observed a marked enhancement by the gluco-corticoids, particularly hydrocortisone (HC), on the thyroxin (T) and triiodothyronine (TIT) induced metamorphosis of three different species of amphibians (*6*).

The effect of HC on T and TIT induced metamorphosis of *Bufo bufo bufo* is shown in Fig. 1. HC accelerates the onset of metamorphosis initiated by both of these hormones. For example, at $3\times10^{-8}M$ TIT or T, HC ($5\times10^{-5}M$) increases three- to four-fold the response of the animal as indicated by the rate of shortening. The sensitivity of the tadpole to lower concentrations of TIT than T has been observed in these and other laboratories (*7*).

Not all the morphological changes keep pace with the decrease in length of the tadpole. Front limb development proceeds well, but limb eruption in the HCT treated animal lags behind tail resorption. Two other species, *Rana hechsheri* and *Rana pipiens*, have shown increased sensitivity to T in the presence of HC.

Figure 2 summarizes the influence of various HC concentrations on the progress of tadpole metamorphosis at two different T concentrations. The two

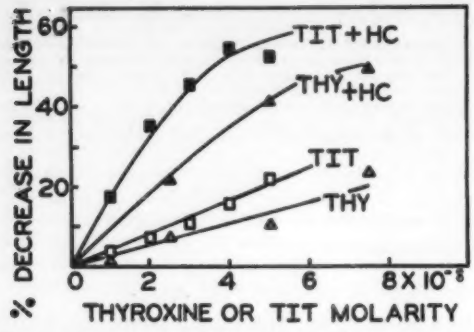


Fig. 1. Effect of $5 \times 10^{-8}M$ hydrocortisone on thyroxin- and TIT-induced metamorphosis. Data are average of duplicate bowls of five *Bufo bufo bufo* tadpoles. Tadpoles with hind limbs barely visible were measured and immersed in 100 ml of indicated molarity. After 40 to 80 hr of incubation at 30°C, they were measured again and the appearance of fore limbs noted. The percentage decrease in length was taken as an index of metamorphosis. Variation of incubation time and thyroxin dosage is probably due to differences in nutritional state or the stage of development of the tadpole.

curves in Fig. 2 represent the two extremes in HC response. While tadpoles from different sources or those incubated with different T concentrations showed considerable variation in response to HC, in all cases a distinct HC effect was observed.

Representative data with other steroids are summarized in Table 1. The lack of significant enhancement by desoxycorticosterone appears to disagree with the report of Gasche (*8*) that desoxycorticosterone acetate accelerates induced metamorphosis. In agreement with Roth (*9*), we have observed that administration of estrone and testosterone enhance and inhibit thyroxin-induced metamorphosis, respectively. We have also found enhancement by the synthetic

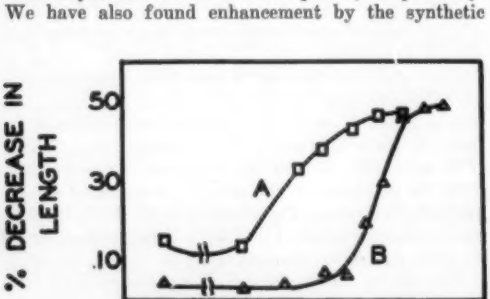


Fig. 2. Effect of varying hydrocortisone concentration on induced metamorphosis at two different thyroxin concentrations. These experiments were performed on different source tadpoles. Curve *A* animals incubated at 30°C for 41 hr with $3 \times 10^{-7}M$ L-thyroxin. Curve *B* tadpoles treated with $7.5 \times 10^{-8}M$ L-thyroxin for 46 hr at 30°C.

Table 1. Effect of steroids on thyroxin-induced metamorphosis of tadpoles. All groups were treated with $1 \times 10^{-7}M$ thyroxine and indicated compound for about 60 hr at 30°C. Steroids were dissolved in tap water or in ethanol, which was removed by evaporation prior to solution. Data summarize representative experiments.

| Steroid | Molarity | Percentage decrease in length |
|---|---|---|
| None | 0 | 17 |
| Hydrocortisone | $3 \times 10^{-5}$ | 49 |
| Cortisone acetate | $3 \times 10^{-5}$ | 44 |
| Cortisone | $2 \times 10^{-5}$ | 39 |
| Desoxycorticosterone | $2 \times 10^{-5}$* | 15 |
| Testosterone | $3 \times 10^{-5}$ | 4 |
| Progesterone | $3 \times 10^{-5}$* | 20 |
| Estrone | $3 \times 10^{-5}$ | 32 |
| Stilbesterol | $2 \times 10^{-6}$* | 38 |

* Toxic at higher concentrations.

estrogen, stilbesterol, at $2 \times 10^{-6}M$. The various hormonal effects may indicate specific interactions or adrenal stimulation. The latter possibility is strengthened by the impressive facilitation of induced meta-

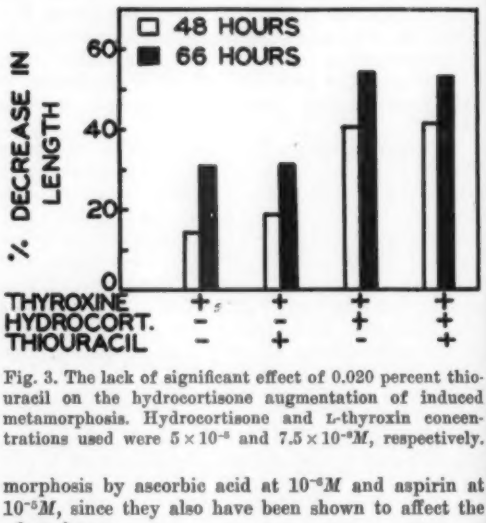


Fig. 3. The lack of significant effect of 0.020 percent thiouracil on the hydrocortisone augmentation of induced metamorphosis. Hydrocortisone and L-thyroxin concentrations used were $5 \times 10^{-5}$ and $7.5 \times 10^{-8}M$, respectively.

morphosis by ascorbic acid at $10^{-6}M$ and aspirin at $10^{-5}M$, since they also have been shown to affect the adrenals.

Preliminary tests suggest that gluco-corticoid acceleration of metamorphosis takes place in the peripheral tissues rather than by way of the production of more thyroid hormone. As is summarized in Fig. 3, thiouracil did not significantly alter the HC augmentation of the thyroxin response. Pretreatment of the animals with 0.01 percent thiouracil for 7 days gave essentially the same results.

Little decisive information is available concerning the role of the adrenal cortex in normal metamorphosis (*10*). Marked changes in adrenal histology during metamorphosis have been noted (*11*). It is not

certain that the only direct action of the pituitary on metamorphosis is its contribution of thyrotrophic hormone. Participation of the gluco-corticoids in amphibian metamorphosis may be rationalized on the basis of the adrenals' recognized role in protein metabolism. Both the thyroid and the adrenal cortex have been implicated in the mobilization of protein reservoirs (*1*). It is anticipated that tail resorption, limb development, and other morphological changes during metamorphosis will be preceded by intense protein mobilization.

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11 August 1954.

## Method for the Chromatographic Separation of Very Polar Steroids


Maurice M. Pechet

*Clinic of General Medicine and Experimental Therapeutics, National Heart Institute, National Institutes of Health, Bethesda, Maryland*


In this paper we present a method for the separation by paper partition chromatography of very polar steroids as exemplified by cortisone (E), hydrocortisone (F), and their tetrahydro and dihydro derivatives (*1*).

All the methods published to date (*2*) have limitations when rapid separation of such steroids at room temperature is required. A chromatographic method of our own (*3*) used for the separation of hydrocortisone, cortisone, and less polar steroid was adapted to the rapid separation at room temperature of very polar steroids by prior impregnation of the filter paper with water or the saturated aqueous phase of the solvent mixture. The method was extended to include a number of different solvent systems. Some 70 solvent mixtures were investigated. The ones reported here have been in use in our laboratory for the past year and give good separations of the very polar steriods.

The solvent systems under consideration contain water in the organic phase which is used as the developing solvent. One-inch strips of Whatman No. 1 filter paper with 1-cm wicks were impregnated thoroughly with the saturated aqueous phase for 15 min in closed vessels. Excess solvent was removed by pressing firmly between sheets of filter paper. The steroids were applied in an area not more than 1 cm in diameter. The strips were suspended in vessels in which the atmosphere had been thoroughly saturated with the solvent mixture. One-half to one hour later the developing solvent was added and the chromatogram was run in descending fashion. Table 1 gives the mobilities of the pure steroids relative to that of cortisone.

Table 1. Mobilities of steroids relative to that of cortisone.

| Compound | Solvent systems* | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Pregnane 3β, 5β, 14β, 19, 21 pentol 20—one | 0.00 | 0.06 | 0.02 | 0.10 | 0.03 | 0.23 |
| Tetrahydro F | .34 | .29 | .20 | .43 | .31 | .35 |
| Tetrahydro E | .67 | .67 | .47 | .62 | .49 | .55 |
| Dihydro E | .68 | .72 | .48 | .67 | .50 | .58 |
| Hydrocortisone | .50 | .39 | .43 | .68 | .62 | .62 |
| Aldosterone | .58 | | | | | |
| Cortisone | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

* Composition of the solvent systems: (1) 200 ml toluene, 100 ml petroleum ether, 15 ml butanol, 15 ml ethanol, 70 ml water. (2) 100 ml toluene, 200 ml petroleum ether, 12 ml butanol, 12 ml ethanol, 80 ml water. (3) 200 ml toluene, 100 ml petroleum ether, 100 ml ethanol, 100 ml water. (4) 150 ml benzene, 400 ml ethanol, 200 ml water. (5) 200 ml benzene, 10 ml ethyl acetate, 50 ml water. (6) 150 ml toluene, 400 ml ethanol, 200 ml water.

In all of these solvent systems the $C_{21}O_5$ steroids move faster than the $C_{21}O_6$. For the $C_{21}O_5$ series, tetrahydro E and dihydro E move faster than hydrocortisone in solvent systems 1, 2, and 3, whereas in solvent systems 4, 5, and 6, tetrahydro E and dihydro E move more slowly than hydrocortisone. The use of solvent systems in which the relative mobilities of steroids can be sufficiently altered so that tetrahydro E and dihydro E can be made in one instance to move between cortisone and hydrocortisone and in another instance between the origin and hydrocortisone, depending on the composition of the solvent system, is of importance in the validation of the method of identification of unknown steroids by mixed chromatograms with known steroids.

In system 1, crystalline aldosterone is readily separated from cortisone and hydrocortisone. The salt-retaining material from human urine (*4*) has the same mobility in this solvent system as the aldosterone prepared from bovine adrenal glands.

Further application of this method to other steroids and cardiac aglycones is in progress.


**References and Notes**

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28 September 1954.


# *Communications*

## On the Legitimacy of Scientific Authorship

A recent communication [J. Wilson, *Science* **120**, 276 (1954)] inveighs against competitive publication. While one agrees wholeheartedly that "the accent must be on the desire to pass along what has been discovered," the extreme form of argument invites certain criticisms.

1) Does employment or promotion really depend on the *number* of publications? Such a claim appears to be a gratuitous attack upon the discrimination of scientists responsible for personnel selection in universities and research institutions. Surely quality is usually considered the most useful criterion of ability. And a paper under one name will be given the greatest weight as evidence of individual worth.

2) Some people are said to put down what everyone knows, and because no one has written it up they get the credit. One may doubt that unpublished studies can be generally known. But, granting failure of the original investigator to publish, it might be argued that he who makes the work public performs a service useful to science. If a man is paid to carry on research (as are most of us now), his duty should be to make the results known, or allow others to do so.

3) Remarks about material that has no business in print seem to imply a widespread failure of editorial function, and perhaps a trace of intellectual snobbery. A young scientist may rely on expert and impartial editorial criticism to develop his standards. Moreover, strictures on third-rate papers have been known to serve as excuse for publishing nothing. Who waits to produce a classic may wait forever, while the second or even fifth-rate scientist makes many useful contributions in his humbler sphere.

4) By omitting names from articles, a helpful guide to quality and reliability is lost.


EVILLE GORHAM

*Freshwater Biological Association,*
*The Ferry House, Ambleside,*
*Westmorland, England*



29 November 1954.


***Eville Gorham's communication came to us originally as a letter expressing private views; but at our instance, he agreed to put it into a form suitable for publication.***

"Whether scientists like it or not, the competitive spirit is now being applied to science no less than to business or industry" writes John Wilson [*Science* **120**, 276 (1954)]. Wilson deplores also the printing of one's name as author of a paper when most of the meat of that article did not originate with the author and asks if there is, among scientists, a mad scramble to get their names in print.

On staffs of institutions where research is the sole or principal function, there may be the scramble that Wilson mentions but it seems to me that he is, in a large measure, incorrect when he frames his picture, as he does, to include scientists in universities. Those individuals have the dual responsibility of teaching and research.

In a university, assistant professors, who prove to be capable teachers although ineffective in research and publication, find out, to quote Wilson, that "either we get papers out or get out." These teachers will probably find their niches in colleges because many colleges make teaching alone the principal responsibility of professors.

Other assistant professors who prove to be highly effective in research and productive in published writing, but ineffective in teaching, also will have to get out and probably will find their niches in organizations with research as their principal function.

There is also the assistant professor who proves to be effective in both teaching and research. Furthermore, the results of his research are worthy of publication and therefore are published. He probably will find his niche in a university and in time will earn promotions up to and including the rank of professor. If so, he repeatedly will have expounded information that mostly is not the result of his own researches. He will have done this in three ways: (i) verbally in lectures, (ii) by demonstrations in the laboratory, and (iii) by publication of articles aimed to inform the elders and parents of his students. He signs his name to articles as a scrivener rather than as a discoverer. The elders pay his salary, in part, for his interpreting science for them. They read his material when few or none would do so if it were anonymous. In fine, the professor publishes results of his research and also interpretations of research.

The university professors that I know "do the best they can" and seem to be unworried by the competi-

tive spirit that admittedly exists. Be there other professors who are worried by such a spirit, probably even they are more useful than they would be in the absence of such a spirit.

E. RAYMOND HALL

*Museum of Natural History, University of Kansas, Lawrence*

6 December 1954

## More on "A New University"

The proposal of William Seifriz [*Science* **120**, 87 (1954)] for "a new university" that would be "a center . . . from which will emanate a culture that man will respect, an intelligent biological system of ethics," will strike a responsive chord in many who feel that the well-rounded man, scientist no less than nonscientist, is the man best equipped to make the greatest contribution toward a sane, orderly and wholesome society.

I wonder whether it is generally known that there already exists in this country an organization—not on so elaborate a scale as a university, but one nevertheless that is well founded, stable, and rapidly growing—which has as its primary objective the effectuation of substantially the same ideals as those the university proposed by Seifriz would advocate.

I refer to the American Humanist Association, with headquarters at Yellow Springs, Ohio. This is a membership organization, which is open to all interested in its program of promoting Humanism—a way of life, or philosophy, firmly based on the findings of science, imbued with the democratic outlook, and cultivating a rational system of ethics, all combining to forecast a culture truly worthy of the respect of mankind. Some call Humanism a religion—not however in the sense of indicating a belief in a deity, for Humanism finds no reliable evidence of a deity in the cosmos, but rather as indicating a personal commitment to the highest ideals human insight has yet evolved.

Humanism emphasizes the dignity inherent in every human being. It teaches that man, within the limitations of his natural environment, has the capability of solving his problems, not only material, but moral; that, just as man has outgrown a supernatural basis for his interpretation of natural phenomena, so also has he outgrown a supernatural basis for his ethics and must develop his ethical concepts on a naturalistic foundation; and that, because this is the only life it seems likely he will live, he ought to make the best of it for himself and for others.

Whether or not the American Humanist Association will evolve into the university that Seifriz envisions, only time will tell. But it offers here and now an opportunity for all interested to participate in and to advance the general program that such a university would foster.

HAROLD R. RAFTON

*Rafton Laboratories, Inc., Andover, Massachusetts*

13 December 1954.

## Hydrolyzed Fish Protein from the Flesh of Waste Fish

During the last few years there has been a fight going on throughout the world against protein malnutrition, which is more serious than vitamin and mineral deficiencies, since protein is essential to the body for its growth, repair, and nutrition and is needed by children and adults alike. The existence of life without protein is not possible. In almost every country today the supply of protein is not adequate, and, as a result, cases of malnutrition are increasing day by day, leading to higher and higher death rates. It is time that attempts were made to correct this deficiency by supplying protein from some untapped resource that is also inexpensive.

Fish is a well-known source of protein, but as yet no attempt has been made to extract cheap protein from the flesh of tons of waste fish that is neither properly utilized nor consumed by human beings. For example, the flesh of sharks and rays is not properly utilized in many places in India because it is not considered palatable. However, we have found that the protein content in these fish is as high as in other edible fish. Our preliminary work has been done on sharks and rays.

The first step in our procedure is to mince thoroughly the flesh of the fish and then to wash it. When this has been done, the fish is boiled from ½ to 1 hr with very dilute acetic acid solution under 80°C until the muscle becomes threadlike when pressed. Then the fish is washed thoroughly to remove the acid and lipids. When the overflow water runs clear, the washing is completed, and the water is pressed out. This substance is completely dried and treated with petroleum ether to eliminate the fat and to increase the keeping quality. This last step is repeated several times.

The resulting complex fat-free protein is insoluble in water and is nondiffusible and difficult to absorb. Therefore, hydrolyzation is necessary to make this protein easily assimilable. Since there is the possibility of destroying some of the amino acid end-products by acid hydrolysis, we used alkali hydrolysis by caustic soda, 10 to 12 percent caustic soda under 80°C. This method is simple to use and is suitable for both laboratory and commercial purposes. When the substance becomes completely liquefied, it is neutralized by commercial acetic acid (85 percent). This neutralized liquid is spray-dried to a flourlike powder that is cream colored and retains its natural flavor. The yield of the finished product is nearly 10 percent of the raw material. The fat-dissolved petroleum ether is distilled to remove pure ether. More than 50 percent can be recovered.

The finished product has an 85-percent protein content, which is much higher than that contained in other foods, both foreign and local. For example, raw or boiled eggs have 11.9-percent protein content; dried eggs, 43.4 percent; cheese, 36.8 percent; roasted chicken, 29.6 percent; frozen raw beef, 20.3 percent;

Table 1. Approximate percentage composition of selected animal protein.

| Amino acids | Beef muscle | Casein | Egg albumen | Protein from waste fish flesh |
|---|---|---|---|---|
| Cystine | 1.1 | 0.35 | 1.9 | 0.49 |
| Lysine | 8.2 | 7.6 | 5.0 | 1 |
| Histidine | 2.9 | 2.1 | 1.7 | 2.5 |
| Arginine | 7.2 | 4.3 | 5.9 | 2.5 |
| Serine, glycine, aspartic acid | 16.7 | 14.3 | 18.7 | 7.3 |
| Threonine, glutamic acid | 20.6 | 27.1 | 21.5 | 12.9 |
| Alanine | 5.6 | 5.5 | 7.2 | 1.5 |
| Tyrosine | 4.4 | 6.7 | 4.3 | 3.0 |
| Methionine, valine | 8.12 | 9.9 | 11.9 | 8.0 |
| Leucine, isoleucine | 13.1 | 16 | 17.1 | 5.3 |

and fresh whole milk, 3.3 percent. This hydrolyzed fish protein contains all the principal amino acids in amounts that are fairly adequate for human consumption (Table 1) in comparison with other food products. It is very useful in treating cases of malnutrition, tuberculosis, and duodenal and ventricular ulcers and as a supplement to the diets of convalescent patients.

The general properties of hydrolyzed fish protein are the following. (i) It is easily soluble in water. (ii) The keeping quality in powder form is quite good. (iii) The whipping power is greater than that of egg albumen. Its properties are such that it could be used in the plastics, paint, leather, and rayon-fiber industries.

By preparing hydrolyzed fish protein on a laboratory scale, it has been found that the cost of the product is such that it can be sold much less expensively than many similar products manufactured by other means. Another aspect to consider in manufacturing this product is the fact that waste resources would be utilized that might otherwise have never come to such prominence in combating malnutrition in the world.

After testing the product on only a few patients, the demand has become very great. The investment for establishing a small plant would be moderate. And there is no doubt that the establishment of such a plant would certainly help millions of children and adults dying of malnutrition.

We express our gratitude to the superintendent and to the staff of the S.C.B. Medical College Hospital, Cuttack, for experimenting with our product on their patients. Affidavits to show the beneficial effects from hydrolyzed fish protein in treating hospitalized patients can be obtained by writing to us. R. Rajgopalan and the staff of the Department of Biochemistry of the Indian Institute of Science, Bangalore, also deserve our gratitude for their scientific help.

G. B. Mohanty
A. B. Roy

*Department of Fisheries, Orissa, India*

10 November 1954.

## Report on Wax from Several Species of *Tillandsia* and from *Ananas comosus* (L.) Merr.

In 1953 we reported (*1*) that a hard wax, melting at 79° to 80°C, was extracted with organic solvents from *Tillandsia usneoides* L., Spanish moss. This wax imparted a glossy finish to woodwork and leather and has since, according to Bennett (*2*), been utilized in automobile polishes on an experimental basis. An investigation of the waxes of other species of this family was undertaken to determine whether the waxes of the epiphytic and terrestrial species were similar and also to find other sources of commercial supply if extraction of Spanish moss wax on a commercial basis became practical. Some species, such as *T. Balbisiana* and *T. fasciculata*, have already been cultivated by florists (*3*) on a limited scale. Cultivation of some species would be necessary if Spanish moss wax became a commercial item.

*Tillandsia tenuifolia* L., *T. juncea* Poir., *T. Balbisiana* Schult., *T. aloifolia* Hook., *T. simulata* Small, *T. fasciculata* Sw., and *T. circinata* Schlecht. all have hard waxes similar to that in *T. usneoides* L. It was reported earlier (*4*) that these species contain estrogenic substances. The waxes of these species comprise 4 to 5 percent of the fresh weight of the plants. From the pineapple, *Ananas comosus* (L.) Merr. of the same family, a soft wax, melting at 51°C, was extracted with organic solvents, such as acetone, chloroform, and petroleum ether. From the waste of pineapple fruits 1.4 percent wax was reclaimed. The pineapple wax had a saponification number of 232.4, an acid value of 57.1, an ester value of 175.3, and an iodine number of 49.9. The wax contained 59.5 percent unsaponifiable material. A positive Liebermann-Burchard reaction (*5*) for steroids was obtained as well as a positive vaginal smear in ovariectomized rats tested by the Allen-Doisy method (*6*), indicating the presence of a substance possessing estrogenic activity in the steroid fraction.

Seldon D. Feurt*
Lauretta E. Fox

*Department of Pharmacognosy and Pharmacology, College of Pharmacy, University of Florida, Gainesville*

### References and Notes

1. S. D. Feurt and L. E. Fox, *Science* **117**, 600 (1953).
2. R. B. Bennett, Engineering and Industrial Experiment Station, Univ. of Florida, personal communication, 30 Aug. 1954.
3. R. Lewis, Orlando, Florida, personal communication, 1 June 1951.
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6. E. Allen and E. A. Doisy, *J. Am. Med. Assoc.* **81**, 819 (1932).

* Present address: Department of Pharmacology, School of Pharmacy, University of Georgia, Athens.

28 September 1954.

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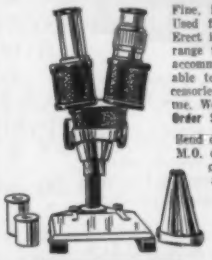

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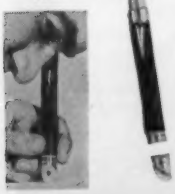

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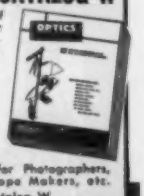

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**Dr. Ferd Williams**, Ph.D in Phys. Chem., Princeton, has been head of the *Light Production Studies Section* at the G-E Research Laboratory since 1949. He is shown with the transparent TV tube which, along with electroluminescent single crystals and a light-amplifying phosphor, are recent achievements of that section.

# New light on luminescence

## General Electric's Dr. Ferd Williams develops equations to predict accurately the role of new activators in phosphors.

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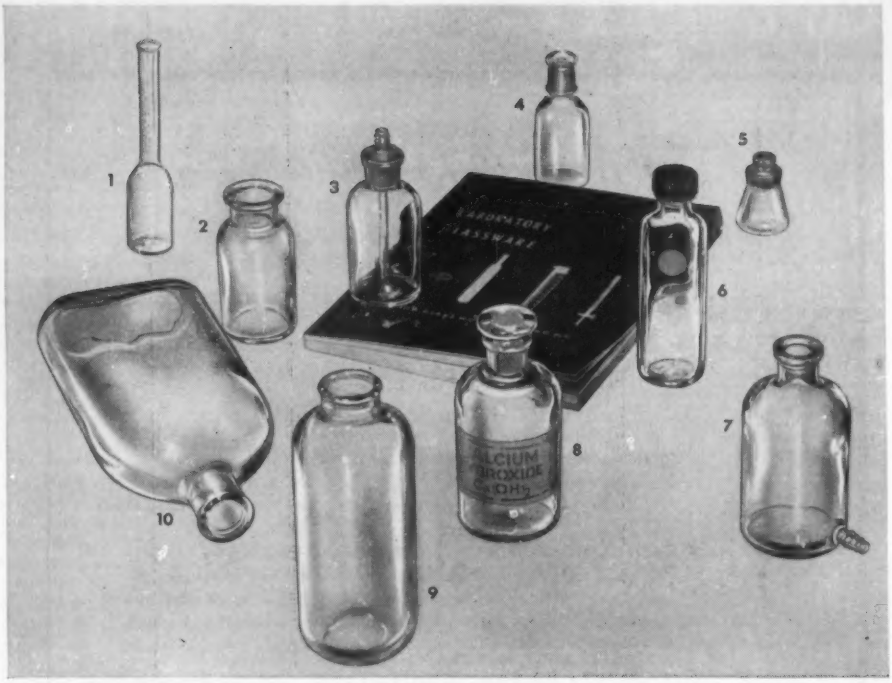


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1) *Lead articles.* Lead articles varying in length from about 1000 to 10,000 words are invited for consideration. These may be general articles or reviews of recent advances in some field. Authors should keep in mind the broad audience of *Science* and should employ reasonably nontechnical language that will be intelligible to most readers.

2) *Technical papers.* Only under exceptional circumstances, such as suitability for conversion to a lead article, will any technical paper of more than four double-spaced, typewritten pages (about 1200 words) be accepted for publication. This includes space occupied by figures, tables, and references. *Most papers should be limited to about 900 words.* However, statements of conclusions without supporting data will not be accepted. *Such data should be included to the extent necessary,* particularly in the form of concise tables. In general, it is inadvisable to submit more than one or two figures.

3) *Communications.* Communications varying in length from several sentences to approximately 600 words will usually be given priority for publication. These may be reports of significant research that for some reason cannot be presented as technical papers, or they may be brief comments of the "Letter to the Editor" type. For the former, supporting data should be included or else a comprehensive account of the work should accompany the communication for the guidance of the referees.

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For more specific information on the preparation of typescripts and illustrations, see *Science* for 10 December 1954, page 7A.

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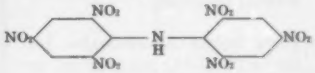

The ominously nitro-begirt aspect of this molecule should not be allowed to divert attention from its useful and unusual ability to precipitate potassium selectively from solution. Its "trivial" name of dipicrylamine suggests a sensitive nature like that of picric acid and the even more sensitive ammonium salt of that acid. Dipicrylamine may not be quite so ready to yield up its potential energy with violent rapidity. All the same, our man who prepares it by further nitrating dinitrodiphenylamine (and anyone who uses it) is well advised to keep his mind on his work. When he has finished purifying it to analytical grade, he labels it *2,2′,4,4′,6,6′-Hexanitrodiphenylamine* and numbers it Eastman 4402.

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*13–17.* American Inst. of Mining and Metallurgical Engineers, annual, Chicago, Ill. (E. H. Robie, 29 W. 39 St., New York 18.)

*14–16.* Nutrition of Plants, Animals, Man. Michigan State College, Centennial Symposium, East Lansing. (Continuing Education Service, Kellogg Center, Michigan State College.)

*14–19.* Latin American Cong. of Physical Medicine, Lima, Peru. (C. L. de Victoria, 176 E. 71 St., New York 21.)

*17–18.* National Conf. on Transitor Circuits, Philadelphia, Pa. (W. J. Popowski, Minneapolis-Honeywell Regulator Co., 176 W. Loudon St., Philadelphia 20.)

*17–19.* American Acad. of Forensic Sciences, Los Angeles, Calif. (W. J. R. Camp, 1853 Polk St., Chicago 12, Ill.)

*28–1.* American Orthopsychiatric Assoc., 32nd annual, Chicago, Ill. (M. F. Langer, AOA, 1790 Broadway, New York 19.)

*28–2.* American Educational Research Assoc., St. Louis, Mo. (F. W. Hubbard, 1201 16 St., NW, Washington 6, D.C.)

**March**

*2–4.* American Assoc. of University Professors, Gatlinburg, Tenn. (R. E. Himstead, AAUP, 1785 Massachusetts Ave., NW, Washington 6, D.C.)

*7–9.* Chemical Inst. of Canada, Divisional Conf. of the Chemical Engineering Div., Ottawa, Ont. (W. M. Campbell, Box 323, Deep River, Ont.)

*7–11.* American Soc. of Photogrammetry, Washington, D.C. (C. E. Palmer, 1000 11 St., NW, Washington 1.)

*7–11.* National Assoc. of Corrosion Engineers, 11th annual, Chicago, Ill. (A. B. Campbell, 1061 M & M Bldg., Houston 2, Tex.)

*14.* American Educational Research Assoc., Denver, Colo. (F. W. Hubbard, 1201 16 St., NW, Washington 6, D.C.)

*14.* Wildlife Soc., Montreal, Canada. (D. L. Leedy, Fish and Wildlife Service, Washington 25, D.C.)

*15–17.* Electrical Utilization of Aluminum, American Inst. of Electrical Engineers, Pittsburgh, Pa. (N. S. Hibshem, AIEE, 33 W. 39th St., New York 18.)

*17–19.* American Physical Soc., Baltimore, Md. (K. K. Darrow, Columbia University, New York 27).

*17–19.* International Symposium on Cardiovascular Surgery, Detroit, Mich. (John Keyes, Henry Ford Hospital, Detroit 2.)

*17–19.* National Wildlife Federation, Montreal, Canada. (C. H. Callison, 232 Carroll St., NW, Washington 12.)

*17–2.* Inter-American Statistical Conf., 3rd, Santiago, Chile. (IASI, Pan American Union, Washington 6.)

*20–23.* American Assoc. of Dental Schools, annual, Chicago, Ill. (M. W. McCrea, 42 S. Greene St., Baltimore 1, Md.)

*24–26.* National Science Teachers Assoc., Cincinnati, Ohio. (R. H. Carleton, 1201 16 St., NW, Washington, D.C.)

*28–31.* American Assoc. of Petroleum Geologists, New York, N.Y. (E. H. Powers, Box 670, Fort Worth, Tex.)

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